Ron Patterson

TRUNKING INTRODUCTION

800 MHz
AND
TRUNKING
INTRODUCTION

WESTERN FTR DISTRICT

August, 1982

800 MHz

MOTOROLA

MAXAR 80 FM Two-Way 800 MHz Mobile/Control Station Radios

10 Watts

Tx = 806-825 MHz
Rx = 851-870 MHz
12V dc/120V ac, 60 Hz

- **Economical Operation/Installation**
- **Simplified Maintenance**
- **Outstanding Audio Quality**
- **Solid-State Reliability**
- **Compact, Rugged Design**
- **Base Replaceable With Mobile**
- **Popular Options**
- **Plug-in MIC**

MAXAR 80 FM Mobile/Control Station Radios

STANDARD

Feature	Description	Benefits
Power	MAXAR 80 provides 10 watts of power in 800 MHz operation.	10 watts of power provides effective and dependable radio coverage over large geographic area.
All Solid State	Transmitter and receiver are 100% solid state.	MAXAR 80 provides full rated transmi and receive power at turn-on. Cooler operation allows longer component li resulting in minimum maintenance required.
Audio Output	MAXAR 80 radio has 3 watts of audio output. One and two frequency radios come standard with an internal speaker and a special acoustically designed grill.	Designed to receive messages loud a clear.
Reverse Burst	Standard on MAXAR 80 radios equipped with PRIVATE-LINE squelch.	Eliminates usual annoying noises hea on receiving end when push-to-talk button is released.
Variable Squelch	Exterior radio knobs for adjusting radio squelch.	Operator can set radio to achieve optimum operation under various environmental conditions.
Polarity Protection	Provides protection against equipment burn-out.	If radio is connected to wrong polarity during installation in a negative groun vehicle, it is protected against damag
Rugged Styling	One piece, strong, molded Cycolac ABS radio housing has safety rounded edges. The MAXAR 80 radio color is Shadow Plum.	Lightweight, durable housing assures low maintenance.
Size	Lightweight, compact, under 165 cubic inches.	Fits easily in most locations.

MAXAR 80 FM Mobile/Control Station Radios

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Variable Squelch	Exterior radio knobs for adjusting radio squelch.	Operator can set radio to achieve optimum operation under various environmental conditions.
Polarity Protection	Provides protection against equipment burn-out.	If radio is connected to wrong polarity during installation in a negative ground vehicle, it is protected against damage.
Rugged Styling	One piece, strong, molded Cycolac ABS radio housing has safety rounded edges The MAXAR 80 radio color is Shadow Plum	Lightweight, durable housing assures low maintenance.
Size	Lightweight, compact, under 165 cubic inches	Fits easily in most locations

Feature	Description	Benefits
Back-Lit Graphics	MAXAR 80 has simplified non-glare graphics.	Easier control reading, day or night.
Key Lock Mount	Mounting tray with trunnion is permanently installed in vehicle.	Trunnion can be locked in place for increased security.
Control Station	Addition of power supply and desk microphone provides control station capability.	Modern styling and compact size allow use almost anywhere
Mobile to Base Flexibility	MAXAR 80 mobile radio can also serve as a control station while station is being serviced.	Allows communications system to stay in operation at all times
Two Channel Capability	A choice of one or two frequency operation is available.	Allows added versatility and more capacity for MAXAR 80 radio systems
PRIVATE-LINE Squelch	Squelch circuit hears only those calls with a particular tone code.	Minimizes annoying message reception from other radio users on same channel. Circuit accepts only those signals with the proper tone code.
Digital PRIVATE-LINE Coded Squelch	Completely solid state, utilizes large scale integrated circuitry.	When a message is finished, receivers are muted until another unit in the same system originates a message. Eighty new and unique system codes assure system longevity.
Multiple Digital PRIVATE-LINE Squelch	Provides up to 4 codes to use with existing DIGITAL PRIVATE-LINE radios.	For accessing multiple repeaters or contacting selected groups within a large fleet.
Time-Out-Timer	Automatically shuts off transmitter after a one minute interval.	Prevents lock-up of a repeater, or tie-up of a channel, by prolonged keying of the transmitter. Emits an alert tone and shuts off the transmitter after the transmission exceeds 60 seconds. Resets transmitter instantly after the microphone button has been released.

Feature	Description	Benefits
Public Address	Used with mobile mic. Up to four 6 watt external speaker amplifiers can be used per radio installation. Operates from push-type external switch	Provides a low cost, dependable PA system for making internal or external announcements from a vehicle
QUIK CALL II Selective Signaling	Allows MAXAR 80 radio to be used as a special paging receiver using alerting tones, horn or light signals until call is acknowledged when driver is recalled to vehicle for the message	Dispatchers can call an individual unit, special group or an entire fleet with only one radio transmission
External Speaker	External speakers in 3 or 6 watts are available in Shadow Plum to match MAXAR 80 radio's color	Provides ability to add louder audio capability in high noise level areas by positioning speaker closer to listener
Inverted Escutcheon	Available for mounting MAXAR 80 radio in positions where a standard escutcheon might be difficult to read.	Provides greater ease of readibility for users.
Quick Disconnect Slide Mount	High quality, 16 ga. steel construction and 3-way spring form base tray and adjustable mount. Push button release disconnects radio cable connections from mount.	Enables operator to quickly remove radio when leaving the vehicle
Handset with Hang-Up Box	Push-to-talk button is conveniently located on cradle for easy one hand operation. Dynamic element and transistorized pre-amplifier strengthen voice signal for improved clarity.	Provides the convenience of a telephone-type handset for crisp and clear communications, especially in high noise level areas
Noise Canceling Microphone	The noise canceling microphone eliminates feedback and prevents outside noise from being transmitted.	Provides clear transmissions especially in high noise environments


Quick Disconnect
Slide Mount


Noise Canceling
Microphone

MAXAR 80 FM MOBILE/Control Station Radio

Performance Specifications

General

Model (Series)	Frequency	Minimum RF Power Output	Dimensions			Primary Input Voltage (3)	Weight(1)	Maximum Primary Power Input	
			H	W	L			Receive(2)	Transmit
D25TSA Mobile L35TSB Control	Tx = 806-825 MHz Rx = 851-870 MHz	10 watts	2⅜″ (59 mm)	6½″ (165 mm)	10½″ (267 mm)	13.8V dc Neg. Grnd.	6.0 lbs. (2700g)	0.3A	5.0A
						120V ac 60 Hz	18 lbs. (8100g)	12W	95W

No. of Frequencies:	One or two frequency models.
Squelch Options:	PRIVATE-LINE tone coded squelch; DIGITAL PRIVATE-LINE coded squelch.
Maximum Power Supply Dimensions:	5¼″H x 5″W x 14″L (134 x 127 x 356 mm).
External Metering Socket:	A single scale 0-50 microampere meter or Motorola portable test set can be used to measure all circuits essential to tuning and checking.

Transmitter

Model Mobile/Control:	D25TSA/L35TSB
Spurious and Harmonic Emissions More Than:	−56 dB
Frequency Stability:	±.00025% from −30° to +60°C ambient (+25°C Reference)
Max. Frequency Separation:	2 MHz
Audio Distortion:	Less than 3% @ 1000 Hz ±3.0 kHz deviation
FM Noise:	55 dB below ±3.0 kHz deviation @ 1000 Hz
Output Impedance:	50 Ohms
Modulation:	15F2, 16F3, 16F9: ±5 kHz for 100% @ 1000 Hz

FCC Designation:

For FCC rules Parts 89, 91 and 93

1 Frequency:	CC5015
2 Frequency:	CC5016

Notes: (1) Control models include weight of power supply
(2) Receiver squelched
(3) 120/220/240V ac, 50/60 Hz power supply is available upon request

Receiver

Model Mobile/Control:	D25TSA/L35TSB
Channel Spacing:	25 kHz
Sensitivity (20 dB Quieting):	0.4μV
(EIA Sinad):	0.3μV
Intermodulation (EIA Sinad):	−70 dB
Selectivity (EIA Sinad):	−70 dB
Spurious and Image Rejection:	−80 dB
Audio Output:	3 watts at less than 5% distortion
Frequency Stability:	±.00025% from −30° to +60°C ambient (+25°C Reference)
Max. Frequency Separation:	2.0 MHz
EIA Modulation Acceptance:	±7.0 kHz
Squelch Sensitivity:	.2μV (all squelch types)
Input Impedance:	50 Ohms

FCC Designation:

1 Frequency:	RC0283
2 Frequency:	RC0284

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1301 East Algonquin Rd., Schaumburg, Illinois 60196
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Specifications are subject to change without notice

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Eq. Cat.	Sec.	Item
R3	2.1	59

MOTOROLA

Solid-State

MICOR Super CONSOLETTE Control Stations

Local, Local/Remote and Remote Models
10 to 0.8W 806-866 MHz

LOCAL/REMOTE MODEL

REMOTE CONTROL MODEL

Feature	Description	Benefits
Connections	All input and out connections, including AC power and antenna, are at the rear of the unit.	Connections are made without need for removing the housing. Servicing can be performed without disturbing the connections.
Metering	Full metering socket capability.	Simplifies tuning.
Single Board Construction	Compact construction means simplified servicing and maintenance.	Reduces maintenance time, labor and costs.

MAXAR 80 FM MOBILE/Control Station Radio

Performance Specifications

General

Model (Series)	Frequency	Minimum RF Power Output	Dimensions			Primary Input Voltage (3)	Weight(1)	Maximum Primary Power Input	
			H	W	L			Receive(2)	Transmit
D25TSA Mobile	Tx = 806-825 MHz Rx = 851-870 MHz	10 watts	2⅜″ (59 mm)	6½″ (165 mm)	10½″ (267 mm)	13.8V dc Neg. Grnd.	6.0 lbs. (2700g)	0.3A	5.0A
L35TSB Control						120V ac 60 Hz	18 lbs. (8100g)	12W	95W

No. of Frequencies:	One or two frequency models.
Squelch Options:	PRIVATE-LINE tone coded squelch; DIGITAL PRIVATE-LINE coded squelch.
Maximum Power Supply Dimensions:	5¼″H x 5″W x 14″L (134 x 127 x 356 mm).
External Metering Socket:	A single scale 0-50 microampere meter or Motorola portable test set can be used to measure all circuits essential to tuning and checking.

Transmitter

Model Mobile/Control:	D25TSA/L35TSB
Spurious and Harmonic Emissions More Than:	—56 dB
Frequency Stability:	±.00025% from —30° to +60°C ambient (+25°C Reference)
Max. Frequency Separation:	2 MHz
Audio Distortion:	Less than 3% @ 1000 Hz ±3.0 kHz deviation
FM Noise:	55 dB below ±3.0 kHz deviation @ 1000 Hz
Output Impedance:	50 Ohms
Modulation:	15F2, 16F3, 16F9: ±5 kHz for 100% @ 1000 Hz

FCC Designation:

For FCC rules Parts 89, 91 and 93

1 Frequency:	CC5015
2 Frequency:	CC5016

Notes: (1) Control models include weight of power supply
(2) Receiver squelched
(3) 120/220/240V ac, 50/60 Hz power supply is available upon request

Receiver

Model Mobile/Control:	D25TSA/L35TSB
Channel Spacing:	25 kHz
Sensitivity	
(20 dB Quieting):	0.4µV
(EIA Sinad):	0.3µV
Intermodulation (EIA Sinad):	—70 dB
Selectivity (EIA Sinad):	—70 dB
Spurious and Image Rejection:	—80 dB
Audio Output:	3 watts at less than 5% distortion
Frequency Stability:	±.00025% from —30° to +60°C ambient (+25°C Reference)
Max. Frequency Separation:	2.0 MHz
EIA Modulation Acceptance:	±7.0 kHz
Squelch Sensitivity:	.2µV (all squelch types)
Input Impedance:	50 Ohms

FCC Designation:

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2 Frequency:	RC0284

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MAXAR 80 FM Two-Way 800 MHz Mobile/Control Station Radios

10 Watts

Tx = 806-825 MHz
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12V dc/120V ac, 60 Hz

- Economical Operation/Installation
- Simplified Maintenance
- Outstanding Audio Quality
- Solid-State Reliability
- Compact, Rugged Design
- Base Replaceable With Mobile
- Popular Options
- Plug-in MIC

Eq. Cat.	Sec.	Item
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MOTOROLA

Solid-State

MICOR
Super CONSOLETTE
Control Stations

Local, Local/Remote and Remote Models
10 to 0.8W 806-866 MHz

LOCAL/REMOTE MODEL

REMOTE CONTROL MODEL

MICOR Super CONSOLETTE Control Stations

Features ● Benefits

All Solid State — Transmitter, receiver, power supply, and control package are 100% solid state ● for greater efficiency and reliability.

Operational Flexibility — Available in local, local/remote, or remote configuration. ● You can choose the configuration that best suits your communication needs.

- **Local Control**—For desk-top and wall mount installations, contains all control functions on the front panel. Matching desk microphone provided. Single frequency or up-to-five frequency models are available.

- **Remote Control** — Single frequency and two-frequency models are available for remote control by tone or dc. Tone control can be accomplished over any voice frequency path whether wire, carrier, or radio frequency link; no need for dc continuity. Conversion from dc to tone control is easily accomplished by simple change-out of the plug-in remote control board. This capability provides insurance against early station obsolescence from loss of dc continuity service. Local operation for servicing is possible after removing cover.

- **Local/Remote Control** — Combines advantages of both operational modes. Can be operated as a local control station during the day and, by flipping a switch, by remote control (tone or dc) from home at night. Gives convenient 24-hour communication capability.

Compact, Convenient, Stylish — The MICOR Super CONSOLETTE Control Station's small size, light weight, and contemporary styling ● make it a welcome addition to the decor of any office. It can be installed on a desk, table-top, or shelf.

Serviceability Features ● Benefits

- All input and output connections, including ac power and antenna, are at the rear of the unit. ● Servicing can be performed without disturbing the connections.

- The radio module can be lifted out of the station chassis for servicing while still connected, ● thus providing the technician full access to the unit while it is in operating condition.

- The remote control board can be set upright ● so that both sides are accessible for servicing.

- The front panel can be pivoted down ● to provide access to all the local controls.

- Full metering socket capability ● simplify tune-ups.

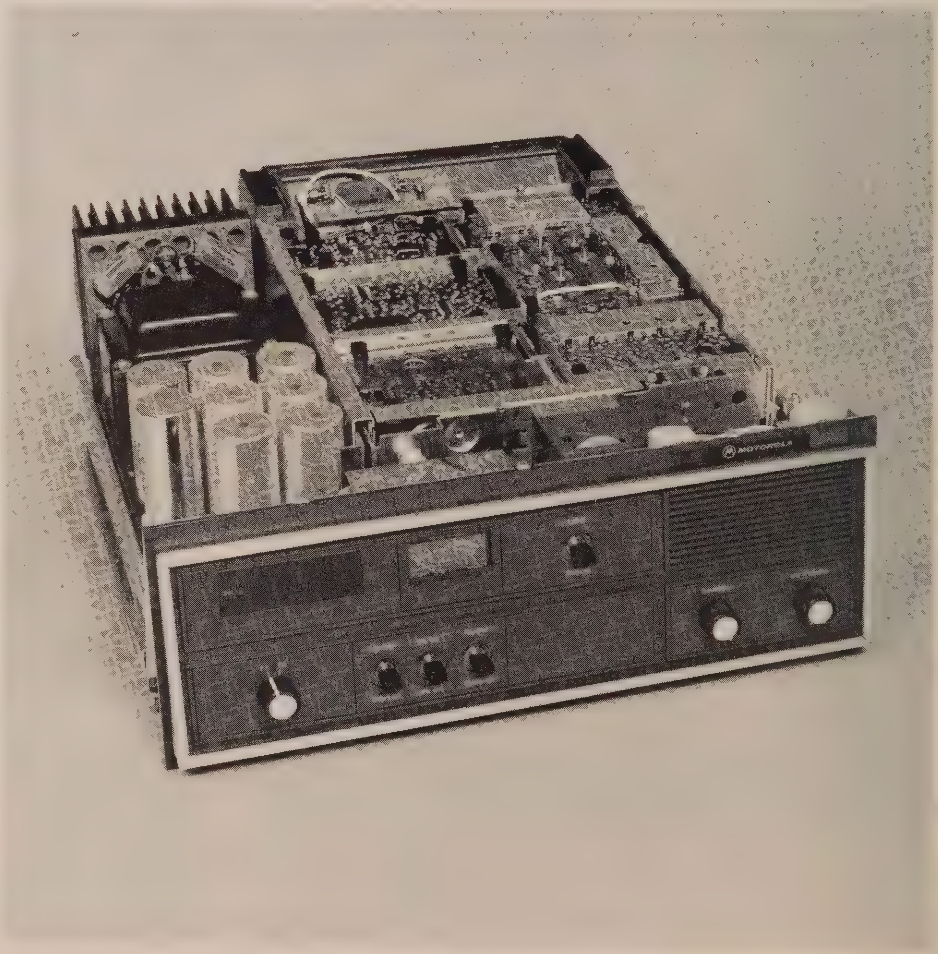
- Service intercom is available as an option on local/remote stations ● to provide communication between the station and its control point.

Options ● Benefits

Frequency Options — On local control stations, you can choose between single-frequency and up to five frequencies. The five-frequency models can be ordered with any combination of from one to five frequencies. Add plug-in crystal oscillators as your system needs increase. Maximum frequency separation is shown in the specifications (back page).

PRIVATE-LINE Squelch — Motorola's tone-coded squelch circuit hears only those calls that have your tone code. ● This option minimizes the annoying reception of messages from other radio users on your channel.

DIGITAL PRIVATE-LINE Coded Squelch —DIGITAL PRIVATE-LINE squelch is a totally new coded squelch system. It



is completely solid state, using large scale integrated circuitry. ● Coded squelch minimizes annoying co-channel message reception. Your operators will only hear those calls that have your individual system code. When a message is finished, your receivers will be muted until another unit in your system originates a message. Operator fatigue is thereby reduced and missed or misunderstood messages are minimized. The 80 new, unique system codes provided by DIGITAL PRIVATE-LINE squelch insure the effectiveness of your communications system for years to come.

Time-Out-Timer — Automatically shuts off the transmitter after a one-minute interval. ● This action prevents transmitter "lock-up" caused by inadvertent or prolonged keying.

Control Accessories—Use the standard desk microphone for local control or use the optional Local Desk Set for extended local control to serve as radio "dispatch points." Select a solid state Remote Control Console or Desk Set for remote control of a station.

Control Point and Intercom Kit — Provides the control point supervisory switch required by the FCC, and intercom between dispatch points and the MICOR Super CONSOLETTE Control Station.

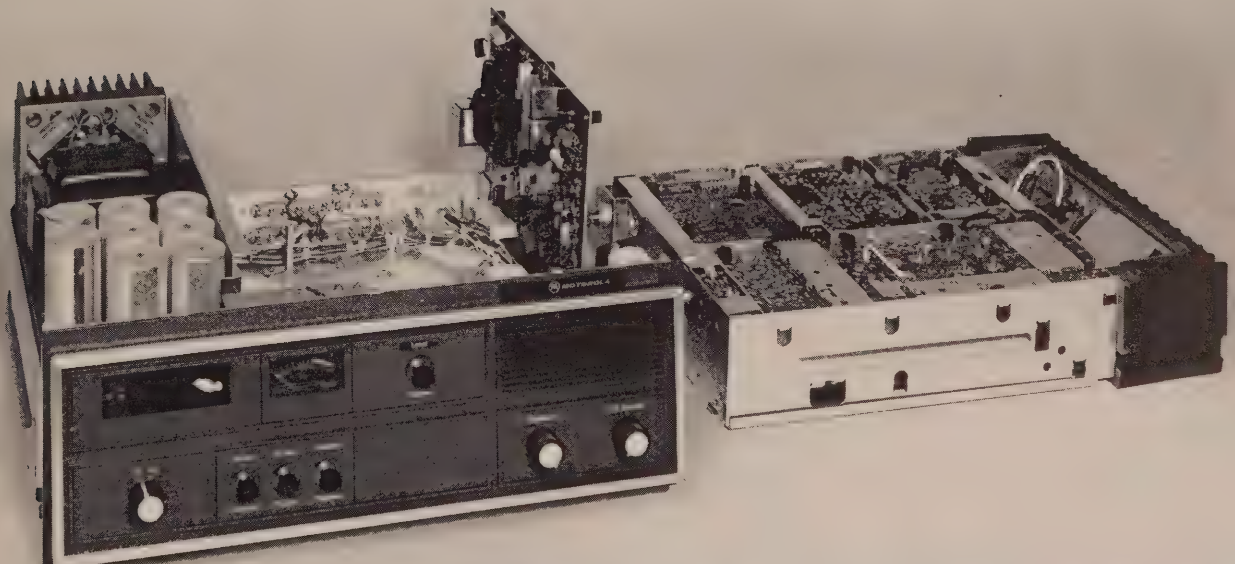
Tone Options — The Alert Tone is an audible tone used to alert the mobiles of a coming transmission. The Five-Frequency Singletone Encoder permits selection of a repeater station or other control functions used in your system. Both options are available with Local Control models only.

Panel Mounted Operation Accessories —Twelve or 24-hour *digital clock* with light emitting diode (LED) readouts: aids with station or message log; stylish addition to any office. VU meter provides constant indication of microphone audio levels, helps dispatcher maintain proper speaking distance.

QUIK-CALL II Mobile Paging—Can be used with QUIK-CALL II Mobile Paging and other paging encoders.

120/220/240V AC, 50/60 Hz Supply—With this option, the MICOR Super CONSOLETTE Control Station can be operated from any of these additional power sources.

DC Only Operation—Operates from 12V dc battery source only.



Radio Module out, Remote Control Board upright to facilitate servicing

MICOR Super CONSOLETTE Control Stations

Performance Specifications

This Equipment Meets or Exceeds the Following Specifications

General

MODEL SERIES	FREQUENCY MHz	MINIMUM RF OUTPUT POWER	INPUT VOLTAGE	AC CURRENT DRAIN (@ 121V, 60 Hz)		DC CURRENT DRAIN @ 13.6V	
				Standby	Transmit	Standby	Transmit
L35RTB	806-866	10W	120V ac @ 60 Hz (120/220/240V ac 50/60 Hz Opt.) (12V dc Opt.)	0.6A	3A	1A	8A

NO. OF FREQUENCIES:	Local Control: Single and multifrequency (up-to-five transmit and receive) models. Local/Remote and Remote: Single and Dual Frequency (up-to-two transmit and receive) models.
SQUELCH OPTIONS:	Carrier squelch, "Private-Line" coded squelch, or "Digital Private-Line" coded squelch
DIMENSIONS:	6⅞″ high x 16¾″ wide x 21″ long. (175 x 425 x 533 mm)
WEIGHT:	Approximately 55 lbs. (25 kg). Shipping weight, including accessories: approx. 59 lbs. (26,8 kg).

Transmitter 806-821 MHz

RF Power Output:	10 W Var to 0.8 W
Output Impedance:	50 ohms
Spurious and Harmonic Emissions:	—80 dB
Frequency Stability:	±.00025% from —30°C to +60°C ambient +25°C ref. ±15% primary voltage variation
Maximum Frequency Separation:	5 MHz
Modulation:	15F2 and 16F3: ±5 kHz for 100% @ 1000 Hz
Audio Sensitivity:	0.080 V ±3 dB for 3 kHz max. deviation @ 1000 Hz
FM Noise:	50 dB below ±3 kHz deviation @ 1000 Hz
Audio Response:	+1, —3 dB of 6 dB/octave preemphasis characteristics from 300 to 3000 Hz
Audio Distortion:	Less than 2% @ 1000 Hz: 3 kHz deviation
FCC Designation:	10W 806-821 MHz · Transmitter CC5012 · RCVR RC0145

The MICOR Super CONSOLETTE Control Station is not recommended for use in multiple station sites. Shield kits are not available for this compact radio package.

Receiver 851-866 MHz

Channel Spacing:	25 kHz
EIA Modulation Acceptance:	±8 kHz
Selectivity—EIA-SINAD:	—80 dB
Frequency Stability:	Within ±.0003% from —30°C to +60°C ambient, +25°C ref. ±15% primary voltage variation
Maximum Frequency Separation:	5 MHz with center tune up element
Input Impedance:	50 ohms
Sensitivity— 20 dB Quieting:	0.50μV
EIA SINAD:	0.35μV
Intermodulation— EIA SINAD:	—75 dB
Spurious & Image Rejection:	—100 dB minimum
Squelch Sensitivity— Carrier Squelch: (adjustable)	6 dB quieting (0.25μV) or less at threshhold
"Private-Line" Squelch (fixed):	6 dB quieting (.25μV) or less
"Digital Private-Line" Squelch (Fixed):	8 dB quieting (.28μV) or less
Audio Characteristics for Telephone Line Output:	+18 dBm at 600 Ω
Response:	+1, —3 dB
Distortion:	3% at 1000 Hz
Hum & Noise:	—55 dB
For Local Speaker Output:	5W at (16 Ω)
Response:	+2, —8 dB
Distortion:	5% at 1000 Hz
Hum & Noise:	—50 dB

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Eq. Cat.	Sec.	Item
R3	2.1	56B

MOTOROLA

800 MHz MICOR Base Stations and Repeaters

(transistorized)
60 to 125 watts, variable
806-866 MHz
Continuous Duty

Introducing Motorola's Advanced Design 800 MHz Base Stations

- These 800 MHz base stations are advanced to the practical limits of today's FM radio technology. The highest reliability semiconductor devices are used throughout the station with the exception of the final amplifier, where high power requirements demand a vacuum tube. The transmitter is capable of continuous full power operation for maximum communications coverage, and a ferro resonant power supply provides constant power output over ±20% line change. Preventive maintenance testing is accomplished without interrupting the system. Easily accessible printed circuit board assemblies and plug-in remote control modules allow fast, easy repair.
- Top performance transmitter — 125 watts RF power at continuous duty rating for optimum system coverage.
- Variable Power Output — Type-accepted for variable power output from 60 to 125 watts, enabling the user to meet the ERP limitations set by the FCC in the 800 MHz spectrum.
- Advanced mechanical design—unified circuit chassis, built-in RF shield and filtering on all stations and repeaters, reduced intercabling, increased reliability.
- Permanently tuned broadband intermediate power amplifier—consistent performance over time and temperature.

Features ● Benefits

Long Life Transmitter Tube—It is impractical to use solid-state devices in the final amplifier due to high power output. Here, a heavy duty power amplifier tube provides long, trouble-free performance. And life expectancy is

increased even further by operation at less than rated capacity. In addition, regulated filament voltage prevents surges that could shorten tube life.

SENSITRON Receiver — Provides 0.5 μV sensitivity, 80 dB selectivity, and 75 dB IM rejection. ● High sensitivity and selectivity combine to insure reception of weak signals even if your station is in a high RF density area. High IM rejection significantly decreases problems caused by intermodulation between other RF sources. These features indicate high receiver performance. And improved receiver performance has the same effect towards increased range as does increasing the power output of the system transmitter.

Continuous Duty Transmitter — 125 watts of continuous RF power is available. ● With this station, there is no performance degradation even with excessive line voltage variation (±20%) and excessive temperature (+60°C).

Power Supply—100% solid-state power supply provides reliable 120V ac, 60 Hz operation with line voltage variations up to ±20%. ● The supply provides transient protection against line surges and against lightning up to 56 watt-seconds at 1,500 volts. The supply is fully regulated to ensure stable, consistent performance.

Safety Interlocks — Protect personnel from inadvertent contact with high voltage when the rear door or the power amplifier access panel is opened. The interlocks reset themselves automatically when the doors are closed.

Installation/Operation Flexibility ● Benefits

Cabinet Versatility — Stations are available in compact cabinets that are rugged yet attractive enough for any office environment. ● These vinyl-covered cabinets will maintain their good appearance for years and are not subject to scratching or chipping. The standard 60-inch indoor COMPA-STATION radio cabinet provides sufficient room to accommodate a second receiver or a duplexer. For outdoor stations, the outdoor upright cabinet is available.

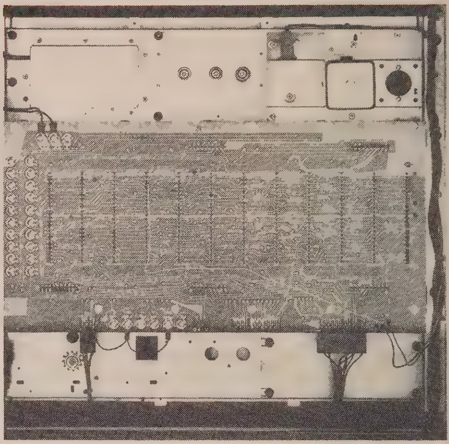
Remote Control—Either dc remote control or tone remote control is available. ● Tone remote control permits station control over any voice frequency path, wire or carrier. There is no need for dc continuity. Tone control has greater versatility; there are more functions to choose from than with dc control. Tone control has greater capability; as many as 11 different station functions can be controlled from a tone remote console. Conversion from dc to tone control is accomplished by simple change-out of plug-in modules, assuring against station obsolescence due to loss of dc continuity.

Reliability and Ease of Service ● Benefits

New UNI-CHASSIS Construction — Remote control functions, receiver circuits, and all low level transmitter circuits are combined on a unified circuit board "chassis." ● This consolidation of these normally separated units reduces intercabling and increases reliability.

Factory Pre-Test—All stations are operated in the factory under normal operating conditions prior to shipping. ● Factory pre-test weeds out most problems which might otherwise occur during initial operation.

Maintenance Features ● Plug-in modules speed up service and maintenance. Standard 19" rack mounting is used for all major chassis, allowing for easy removal and replacement for service or for relay rack mounting. Metering sockets and optional metering panel make servicing much easier. Service intercom is also optionally available for providing communications between the remote console and station.



Consolidating many normally-separated circuits onto this Uni-Chassis circuit board "chassis" reduces intercabling while increasing serviceability.

Options ● Benefits

DIGITAL PRIVATE-LINE Coded Squelch —DIGITAL PRIVATE-LINE squelch is a totally new coded squelch system. It is completely solid state, using large scale integrated circuitry. Coded squelch eliminates annoying co-channel message reception. ● Your operators will only hear those calls that have your individual system code. When a message is finished, your receivers will be muted until another unit in your system originates a message. Operator fatigue is thereby reduced and missed or misunderstood messages are minimized. The 80 new, unique system codes provided by DIGITAL PRIVATE-LINE squelch insure the effectiveness of your communications system for years to come.

Two Frequency Operation—Tone or dc remote control stations are available with two-frequency transmit and receive. Two-receiver models are also available.

Duplex Operation ● RT repeaters are available that can transmit and receive simultaneously without degrading radio performance. RF shield and filter kits are included.

Time-Out Timer—The timer is adjustable to ½, 1, 2, 4 or 8 minute intervals. It is provided as a standard feature with repeaters. ● Time-out timer prevents transmitter lock-up by automatically shutting off the transmitter after a preset interval.

Voting Encoder ● Permits use of the receiver in a SPECTRA-TAC satellite receiver voting system.

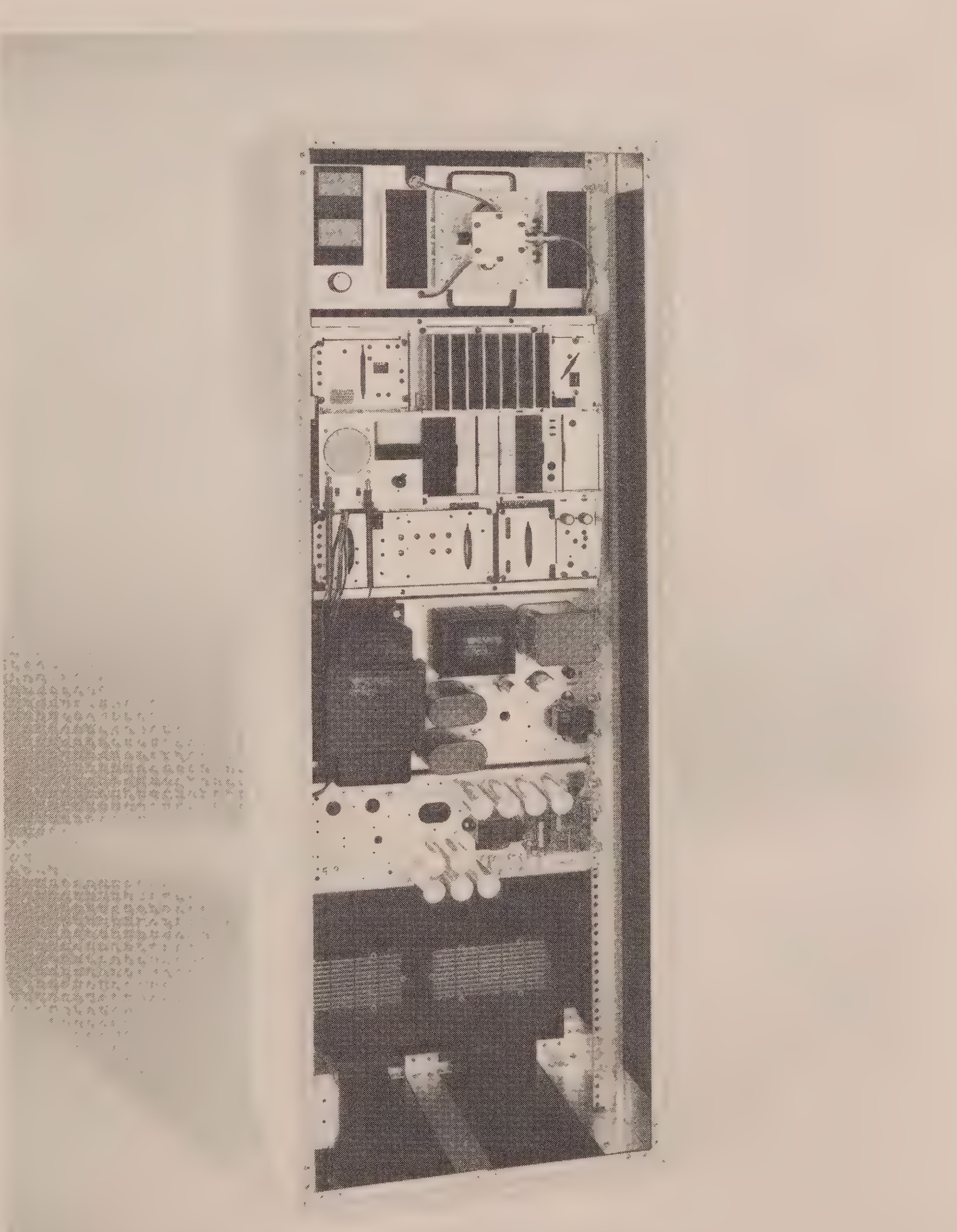
Remote Control Station
Indoor cabinet
22″W x 60″H x 19¼″D
(559 x 1524 x 489 mm)
Shipping Wt. 300 lbs.
(136 kg)

Remote Control Station
Optional Indoor Cabinet
22″W x 46″H x 20″D
(559 x 1169 x 508 mm)
Shipping Wt. 290 lbs.
(132 kg)

Outdoor upright model also available

Other Options Available

- PRIVATE-LINE Squelch
- Transmit Switch
- Mute 2nd Receiver
- Control Point Intercom (with speaker)
- Remote Squelch Control
- Paging/PL Transmit On-Off
- Singletone Decoder
- Four-Wire Audio
- QUIK-CALL II Mobile Paging
- Repeater set-up and knock-down
- Wild Card
- Metering/Intercom



Station shown with optional metering/intercom kit.

MICOR Base Stations and Repeaters (806-866 MHz)

Performance Specifications

General

Models:	C75RCB Series
No. of Frequencies:	Single and two-frequency stations (DC or tone remote control)
Squelch Options:	Carrier Squelch, "Private-Line" coded squelch or "Digital Private-Line" coded squelch.
AC Power Input:	120V, 60 Hz, single phase (3-lead grounding-type cable supplied).
AC Current:	Standby—2.6A at 121V, 60 Hz Transmit—7.6A at 121V, 60 Hz
Metering:	2 panel-mounted meters provide indication of power amplifier voltage & current essential for tuning and checking. Optional internal-mounted meter used to measure receiver and exciter circuits essential for tuning and checking.

Transmitter

Frequency:	851-866 MHz
RF Power Output:	60 to 125 watts, variable
Output Impedance:	50 ohms
Final RF Amplifier:	3CX400U7 Type Tube
Frequency Stability:	±.0001% from −30°C to +60°C ambient (25°C Ref.)
Modulation:	15F2, 16F3 & 16F9: ±5 kHz for 100% @ 1000 Hz.
Audio Sensitivity Local Control:	0.12V ±3 dB for 60% max. deviation @ 1000 Hz
Remote Telephone Line:	−20 dBm max. for 60% max. deviation @ 1000 Hz
Antenna Connectors:	
Base Station:	Type "N"
Repeater Station:	Xmtr—Type "N" Rcvr—Type "BNC"
Conducted Spurious & Harmonic Emissions:	−85 dB
FM Noise:	55 dB below 60% system deviation @ 1000 Hz
Audio Response:	+1, −3 dB from 6 dB/octave pre-emphasis 300-3000 Hz reference to 1000 Hz.
Audio Distortion:	Less than 2% @ 1000 Hz; 60% system deviation
FCC Designation:	CC5011 Licensable under FCC rules Part 90 for 15F2, 16F3 and 16F9 emissions.

Receiver

Frequency:	806-821 MHz
Channel Spacing:	25 kHz
EIA Modulation Acceptance:	±8 kHz minimum
Selectivity— EIA SINAD:	−80 dB
Frequency Stability:	±.0002% from −30°C to +60°C ambient (+25°C ref.)
Sensitivity— 20 dB quieting:	Less than 0.5 μV
EIA SINAD:	Less than 0.35 μV
Intermodulation— EIA SINAD:	−75 dB
Spurious & Image Rejection:	100 dB
Squelch Sensitivity— Carrier Squelch (adjustable):	6 dB Quieting (.25 μV) or less at threshold
"Private-Line" Squelch (fixed):	6 dB Quieting (.25 μV) or less
"Digital Private-Line" Squelch (fixed):	8 dB Quieting (.28 μV) or less
Audio Characteristics— Remote Control Models:	*Telephone Line:* Output: +18 dBm at 600 ohms Response: +1, −3 dB Distortion: 3% at 1000 Hz Hum & Noise: −55 dB *For Local Speaker:* Output Available: 5 watts at 8 ohms Response: +2, −8 dB Distortion: 5% at 1000 Hz Hum & Noise: −50 dB
RF Input Impedance:	Nominal 50 ohms
FCC Rcvr. Cert. Number:	RC0135

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Support Services

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MOTOROLA

Communications and Electronics Inc.

A subsidiary of Motorola, Inc.
1301 East Algonquin Road, Schaumburg, Illinois 60196
Telephone (312) 397-1000

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MOTOROLA

SYNTOR X

800 MHz Conventional Dispatch
FM Two-Way Radio

806-870 MHz
35 watts

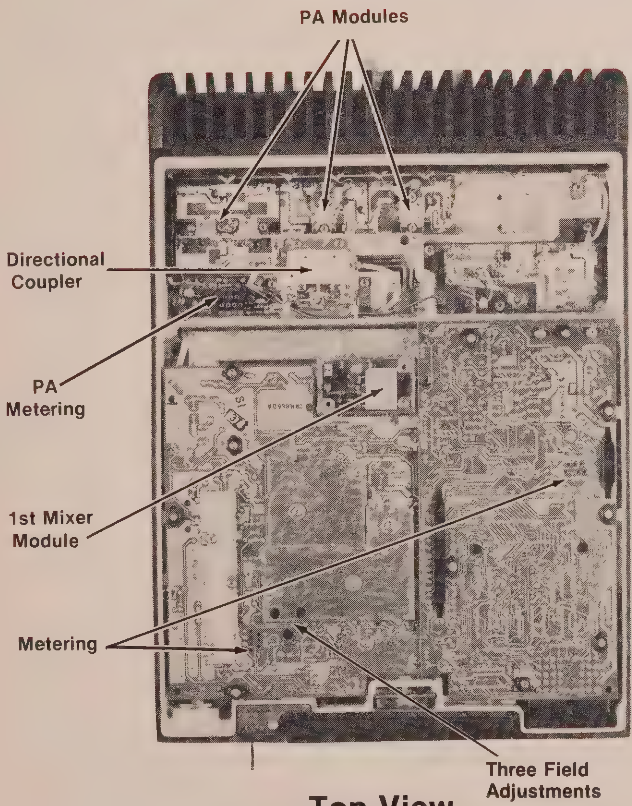
- TRAC-MODE Microprocessor Control with Mode-Select Operation.
- 19 MHz Frequency Separation. Transmit and Receive on any combination of 800 MHz conventional dispatch frequencies.
- Optional Repeater Talk-Around.
- Only 3 Field Adjustments For Simplified Maintenance.
- Environmentally Protected:
  - —MIL STD 810C Shock, Vibration, Rain, Dust and Salt Fog
  - —U.S. Forest Service Vibration
  - —Twice EIA Shock Amplitude
  - —Temperature Range −40 °C to +70 °C
- "SYSTEMS RADIO" model for sophisticated multiple mode applications.
- "COMMERCIAL RADIO" model for 1 and 2 frequency operation.

SYNTOR X 800 MHz FM Two-Way Radio

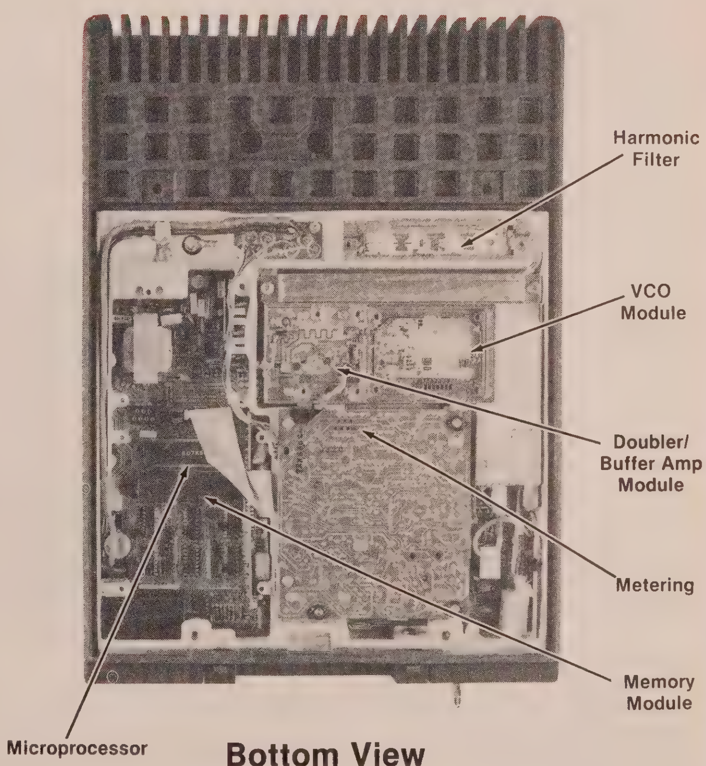
[illegible]

Feature	Description	Benefits
TRAC MODE Microprocessor Control System	The TRAC MODE microprocessor system controls major radio functions. Using a firmware program, the microprocessor "reads" specific information from a single plug-in Memory Module. Information programmed into the memory for customers individual radio functions includes: • Transmit and Receive Frequencies • PRIVATE-LINE and DIGITAL PRIVATE-LINE squelch codes • CHANNEL SCAN monitoring frequencies and priorities • Time-out-timing • "AND" or standard squelch.	The TRAC MODE microprocessor system gives you flexibility never before available in a single radio unit. To add or change functions, you replace only the Memory Module, not the entire radio. You can use the same radio, with different Memory Modules, for a variety of fleets or subfleets. Your spare radio inventory can be greatly reduced, since all radios are interchangeable. SYNTOR X radio saves you time, money and space by doing the job that would formerly require a larger, more complicated radio.
Mode Select Operation	Mode Select operation is a major feature of the TRAC MODE system. A "mode" is the list of characteristics or functions performed on a channel. With Mode Select options, popular auxiliary functions can be "slaved" to the control head selector switch. Separate controls and control heads are eliminated. Mode Select enables you to simultaneously select: • Transmit and receive frequency • PRIVATE-LINE operation on some channels, DIGITAL PRIVATE-LINE or carrier squelch on others. • "Slaved" multiple PRIVATE-LINE or DIGITAL PRIVATE-LINE squelch select—transmit or receive. For the first time, you can mix all three *in a single radio.* • PRIVATE-LINE squelch disable (DIGITAL PRIVATE-LINE too)! • CHANNEL SCAN monitoring, including which channels are to be scanned and with what priority. • Time-out-timer duration.	Mode Select simplifies radio operation. It's like "one button tuning" on a color TV. The radio operator has only one switch to control, making operation quicker and less confusing. This virtually eliminates the chance of putting the radio into an invalid operating mode, a possibility with other control heads. As a result, there is less chance of missed messages. With less time wasted, dispatcher, mobile operator, and serviceman all benefit.
Broad-Band Operation	The SYNTOR X radio will transmit and receive on any combination of authorized frequencies in the entire 800 MHz conventional dispatch band. With no degradation of specs.	One radio can operate in different systems on widely separated frequencies. Frequencies can be added or changed without retuning or realignment.
Synthesized	The synthesizer generates all RF frequencies electronically, eliminating the need for individual channel elements. The SYNTOR X synthesizer also has a built-in "Fast Lok" feature to handle priority CHANNEL SCAN monitoring options and data applications that need fast frequency switching.	Multiple Frequency operation is more ecomomical. Changing or adding frequencies is greatly simplified. With SYNTOR X radio, the bulk and expense of crystals or channel elements is eliminated, both in the radio and in the spare parts inventory.

Feature	Description	Benefits
Operator Select CHANNEL SCAN Monitoring	Pushbutton operation in SYSTEMS•S module. Radio operator manually selects from one to eight non-priority channels.	For those who prefer manual CHANNEL SCAN monitoring. Priority channels are automatically selected by the Mode Select switch.
Time-out-Timer	Programmed into the radio to automatically turn the transmitter off and provide an alert tone when transmission exceeds a preset time. Timing can be programmed for either a fixed 60 seconds. or selectable by mode in 15 second steps up to 7 minutes and 45 seconds.	Prevents lock-up of a repeater or tie-up of a channel by prolonged keying of the transmitter. Each mode can have a different time-out period to accommodate specific system requirements.
"AND" Opening Squelch	Programmed into the radio as an alternative to coded squelch controlled "on-hook" opening. The proper RF carrier level **and** coded squelch are required to unmute. Muted only when the proper code disappears.	Provides the pricacy and fading protection of coded squelch, yet allows operators to select the signal quality required to unmute the receiver while "on-hook" by using squelch setting. Can be used to eliminate messages from distant co-users having the same frequency and squelch code.



Top View



Bottom View

SYNTOR X 800 MHz FM Two-Way Radio

Standard

Feature	Description	Benefits
TRAC MODE Microprocessor Control System	The TRAC MODE microprocessor system controls major radio functions. Using a firmware program, the microprocessor "reads" specific information from a single plug-in Memory Module. Information programmed into the memory for customers individual radio functions includes: • Transmit and Receive Frequencies • PRIVATE-LINE and DIGITAL PRIVATE-LINE squelch codes • CHANNEL SCAN monitoring frequencies and priorities • Time-out-timing • "AND" or standard squelch.	The TRAC MODE microprocessor system gives you flexibility never before available in a single radio unit. To add or change functions, you replace only the Memory Module, not the entire radio. You can use the same radio, with different Memory Modules, for a variety of fleets or subfleets. Your spare radio inventory can be greatly reduced, since all radios are interchangeable. SYNTOR X radio saves you time, money and space by doing the job that would formerly require a larger, more complicated radio.
Mode Select Operation	Mode Select operation is a major feature of the TRAC MODE system. A "mode" is the list of characteristics or functions performed on a channel. With Mode Select options, popular auxiliary functions can be "slaved" to the control head selector switch. Separate controls and control heads are eliminated. Mode Select enables you to simultaneously select: • Transmit and receive frequency • PRIVATE-LINE operation on some channels, DIGITAL PRIVATE-LINE or carrier squelch on others. • "Slaved" multiple PRIVATE-LINE or DIGITAL PRIVATE-LINE squelch select—transmit or receive. For the first time, you can mix all three *in a single radio.* • PRIVATE-LINE squelch disable (DIGITAL PRIVATE-LINE too)! • CHANNEL SCAN monitoring, including which channels are to be scanned and with what priority. • Time-out-timer duration.	Mode Select simplifies radio operation. It's like "one button tuning" on a color TV. The radio operator has only one switch to control, making operation quicker and less confusing. This virtually eliminates the chance of putting the radio into an invalid operating mode, a possibility with other control heads. As a result, there is less chance of missed messages. With less time wasted, dispatcher, mobile operator, and serviceman all benefit.
Broad-Band Operation	The SYNTOR X radio will transmit and receive on any combination of authorized frequencies in the entire 800 MHz conventional dispatch band. With no degradation of specs.	One radio can operate in different systems on widely separated frequencies. Frequencies can be added or changed without retuning or realignment.
Synthesized	The synthesizer generates all RF frequencies electronically, eliminating the need for individual channel elements. The SYNTOR X synthesizer also has a built-in "Fast Lok" feature to handle priority CHANNEL SCAN monitoring options and data applications that need fast frequency switching.	Multiple Frequency operation is more ecomomical. Changing or adding frequencies is greatly simplified. With SYNTOR X radio, the bulk and expense of crystals or channel elements is eliminated, both in the radio and in the spare parts inventory.

SYNTOR X 800 MHz FM Two-Way Radio

Feature	Description	Benefits
TRAC MODE Microprocessor Control System	The TRAC MODE microprocessor system controls major radio functions. Using a firmware program, the microprocessor "reads" specific information from a single plug-in Memory Module. Information programmed into the memory for customers individual radio functions includes: • Transmit and Receive Frequencies • PRIVATE-LINE and DIGITAL PRIVATE-LINE squelch codes • CHANNEL SCAN monitoring frequencies and priorities • Time-out-timing • "AND" or standard squelch.	The TRAC MODE microprocessor system gives you flexibility never before available in a single radio unit. To add or change functions, you replace only the Memory Module, not the entire radio. You can use the same radio, with different Memory Modules, for a variety of fleets or sub-fleets. Your spare radio inventory can be greatly reduced, since all radios are interchangeable. SYNTOR X radio saves you time, money and space by doing the job that would formerly require a larger, more complicated radio.
Mode Select Operation	Mode Select operation is a major feature of the TRAC MODE system. A "mode" is the list of characteristics or functions performed on a channel. With Mode Select options, popular auxiliary functions can be "slaved" to the control head selector switch. Separate controls and control heads are eliminated. Mode Select enables you to simultaneously select: • Transmit and receive frequency • PRIVATE-LINE operation on some channels, DIGITAL PRIVATE-LINE or carrier squelch on others. • "Slaved" multiple PRIVATE-LINE or DIGITAL PRIVATE-LINE squelch select—transmit or receive. For the first time, you can mix all three *in a single radio.* • PRIVATE-LINE squelch disable (DIGITAL PRIVATE-LINE too)! • CHANNEL SCAN monitoring, including which channels are to be scanned and with what priority. • Time-out-timer duration.	Mode Select simplifies radio operation. It's like "one button tuning" on a color TV. The radio operator has only one switch to control, making operation quicker and less confusing. This virtually eliminates the chance of putting the radio into an invalid operating mode, a possibility with other control heads. As a result, there is less chance of missed messages. With less time wasted, dispatcher, mobile operator, and serviceman all benefit.
Broad-Band Operation	The SYNTOR X radio will transmit and receive on any combination of authorized frequencies in the entire 800 MHz conventional dispatch band. With no degradation of specs.	One radio can operate in different systems on widely separated frequencies. Frequencies can be added or changed without retuning or realignment.
Synthesized	The synthesizer generates all RF frequencies electronically, eliminating the need for individual channel elements. The SYNTOR X synthesizer also has a built-in "Fast Lok" feature to handle priority CHANNEL SCAN monitoring options and data applications that need fast frequency switching.	Multiple Frequency operation is more ecomomical. Changing or adding frequencies is greatly simplified. With SYNTOR X radio, the bulk and expense of crystals or channel elements is eliminated, both in the radio and in the spare parts inventory.

Feature	Description	Benefits
PRIVATE-LINE and DIGITAL PRIVATE-LINE Coded Squelch	All PRIVATE-LINE and DIGITAL PRIVATE-LINE squelch codes are programmed into the Memory Module, making both types of coded squelch and carrier squelch available in the same radio. Transmit codes may differ from receive codes without restriction. All standard CTCSS and Digital codes are available. Codes may be changed by simply plugging in a different Memory Module.	All the traditional benefits of coded squelch are now available in a single radio package. SYNTOR X radio can operate into different systems having different frequencies and different squelch codes—single, multiple or mixed. Large inventories of reeds or code generation devices are also eliminated.
Positive/Negative Ground	The SYNTOR X radio unit will operate in either positive or negative ground vehicles. The correct polarity cable kit is required in the vehicle.	Provides complete fleet interchangeability, regardless of vehicle polarity. The possibility of damage from incorrect installation is reduced. Separate converter kits are eliminated.
Simplified Maintenance	The radio's electronics are divided into only five major subassemblies with "plug together" printed circuit boards. Standard Motorola centralized metering and **only 3 field adjustments** helps simplify servicing or replacing parts.	All five major subassemblies can be removed and replaced easily. The TRAC MODE microprocessor can be electonically "removed" by a simple procedure to isolate adjacent circuits for analysis. This means added speed and flexibility in maintenance and repair operations.
Environmentally Protected	The SYNTOR X radio unit meets MIL-STD 810C for shock, vibration, rain, salt and sand dust atmospheres—all tougher standards than EIA. The SYNTOR X radio unit also meets U.S. Forest Service vibration standards and achieves twice the EIA shock amplitude specification. It features a heavy duty, one-piece cast aluminum housing and cover and a solid steel mounting tray for added reliability in the rugged mobile environment.	When mounted in places like police car trunks, radios can be exposed to wet boots, towing chains, shovels, etc. With SYNTOR X radio, the size, cost and extra installation of a separate weatherproof box for protection is eliminated. Even out of its mounting tray, the unit is still weatherproof.
Meets MIL STD 810C (March 1975)	Some radio applications and operating regions are extra heavy duty in nature—with constant vibration like cement mixer trucks or oil drilling platforms, dusty desert ranching, salty seacoast fog. or off-road shock. In these environments, SYNTOR X radio provides an extra margin of toughness. This radio meets both tradional EIA standards, as well as MIL-STD 810C tests, for added reliability. To pass MIL-STD 810C, the radio is subjected to:	**Rain test.** Two inches or more an hour with a 40 mph wind for two hours. **Sand dust test.** 28 hours with wind-driven fine sand dust. **Salt test.** 48 hours in corrosive salt fog over a **wide** range of temperature and humidity. **Shock test.** While mounted, passes two 60 g shocks—on all 6 sides. **Vibration test.** Passes vibration frequencies from 5 to 500 Hz with up to twice the movement of the EIA vibration test—for a period of 9 hours..
Temperature	The SYNTOR X operating temperature range is −40°C to +70°C.	Performs to specification over severe temperature extremes.

Feature	Description	Benefits
Repeater Talk-Around	Talk-Around operation can be selected either by the Mode-Select switch or by a separate pushbutton	Provides direct mobile-mobile and mobile-portable communications
Multiple PRIVATE-LINE and DIGITAL PRIVATE-LINE Coded Squelch	Generated by the microprocessor and programmed into the Memory Module squelch codes are activated by the Mode Select switch as desired. Also available in operator select Systems 90•S accessory versions ("VBJ" model only)	For repeater access, selective call and other systems uses. One radio can operate into both PRIVATE-LINE and DIGITAL PRIVATE-LINE coded squelch systems
Mode Select CHANNEL SCAN Monitoring	Scan list, scan "on/off" and scan priorities are all programmed into the Memory Module and activated by the Mode Select switch • Scan Display—Available as a separate SYSTEMS 90•S housing module or integral to the pushbutton control head The scan indicator lights display which channel is being heard on the speaker One and two priorities are available • Internal Scan—Two different channels or two channels plus a priority channel can be scanned for each position of the Mode Select switch. No visual indication of received channel	CHANNEL SCAN monitoring operation is greatly simplified The radio operator does not have to operate any controls except the Mode Select switch Channels to be scanned and with what priority are already programmed into the radio Scan display shows which channel the scan is locked to CHANNEL SCAN monitoring with display and Internal Scan with priority, lock to the presence of RF carrier and immediately unmute the speaker Internal Scan without priority locks to the presence of RF carrier and unmutes the speaker if the proper squelch code is also present "VCJ" model available with Internal Scan without priority only

DISPLAY LIGHTS
- Scan "ON"—shows channel being received
- Scan "OFF"—shows selected mode

"CHANNEL SCAN" MONITORING PRIORITY LIGHT
- Priority—steady illumination
- Priority 2—flashing illumination

MODE-SELECT SWITCHES

Provides Push Button Select of up to eight transmit and receive frequencies. Can also activate for each mode:
- Squelch codes
- Time-out time
- "AND" or standard squelch
- Scan "ON/OFF"
- Scan List
- Priority frequency
- Priority 2 frequency

REPEATER TALK-AROUND
- "REPEAT" Activated—All modes operate as repeater pairs
- "DIRECT"Activated—Transmit frequency becomes the same as the receive frequency for Talk-Around.

MANUAL SCAN "ON/OFF"
- Scan "ON/OFF" by-Mode is also programmed into the radio.

5 Mode Control Head with integral "Channel Scan" monitoring display

SYNTOR X 800 MHz FM Two-Way Radio

Performance Specifications

General

Number of Modes:	Frequency pairs are limited to five for any one licensee per FCC Rules and Regulations. One, Two, Five and Eight Mode configurations are available to accommodate Mode-Select repeater talk-around and multiple repeater selection.
Squelch Options:	"Private Line" and "Digital Private-Line" coded squelch are standard and available within the same radio unit. Carrier squelch and multiple coded squelch are optional.
Primary Power:	± 12V dc using a DC isolated floating ground system. Radio supplied for operation with negative ground vehicles. Optional cable kit permits operation with positive gound vehicles.
Radio Unit Dimensions:	2.5″ H x 11.5″ W x 16.0″ L (63.5 mm x 292 mm x 406 mm).
Radio Unit Weight:	Approximately 22.5 Lbs. (10.2 kg). Shipping weight approximately 37.5 Lbs. (17 kg).
Metering:	A single scale 0-50 microampere meter or Motorola portable test set can be used to measure all circuits essential to checking and adjustments.

Model (Series)	**Maximum Number of Modes**	**Frequency MHz**	**Minimum RF Power Output**	**Maximum Battery Drain (inc. std. accessories)**		
				Standby @ 13.8v	**Receive at Rated Audio @ 13.8v**	**Transmit @ Rated Power**
T45VBJ	Eight	TX: 806-825 (851-870 optional) RX: 851-870	35W	0.9A	3.3A	13A
T45VCJ	Two					

Transmitter

Output Impedance:	50 ohms	
Spurious and Harmonic Emissions:	More than 85 dB below carrier (for EIA spec., RS152B)	
Frequency Stability:	± .0002% of assigned center frequency from −40°C to +70°C ambient (+25°C reference)	
Maximum Frequency Separation:	19 MHz within each of two groupings without degradation	
Modulation:	15F2 & 16F3, ±5 kHz for 100% @ 1000 Hz	
Audio Sensitivity:	0.080V ±3 dB for 60% maximum deviation @ 1000 Hz	
FM Hum and Noise EIA Method:	RS152B Response −50 dB	Companion Rcvr Response −60 dB
Audio Response:	+1, −3 dB of 6 dB/octave pre-emphasis characteristic from 300 to 3000 Hz	
Audio Distortion:	Less than 2% @ 1000 Hz, 60% maximum deviation	
FCC Designation:	CC5023—Licensable under FCC rules Part 90 for 15F2, 16F3 and 16F9 emission	

Control Head

Type:	**Rotary**	**Pushbutton**
Dimensions: excluding mounting bracket	6⅞″ W x 2″ H x 3¾″ D (175mm x 51mm x 95mm)	6⅞″ W x 2¼″ H x 5¾″ D (175mm x 57mm x 146mm)
Weight:	1 lb. (453g)	1.5 lb. (680g)
Current Drain:	150 ma	150 ma (2 mode) 350 ma (5 mode) 500 ma (8 mode)

Speaker

Dimensions: (excluding mounting bracket)	5″ x 5″ x 2½″ (127 mm x 63 mm)
Weight:	1.5 lbs. (680g)

Receiver

Imput Impedance:	50 ohms
EIA Modulation Acceptance:	±7.0 kHz minimum
Frequency Stablity:	± .0002% of assigned center frequency from −40°C to +70°C ambient (+25° reference)
Maximum Frequency Separation:	19 MHz without degradation
Sensitivity: **20 dB Quieting** **EIA SINAD**	 0.35 μV 0.25 μV
Selectivity EIA SINAD	±25 kHz: 80 dB ±100 kHz: 90 dB
Intermodulation EIA SINAD	80 dB
Spurious & Image Rejection:	100 dB
Squelch Sensitivity:	6 dBQ: 0.17 μV Carrier Squelch: Threshold setting Coded Squelch: Fixed "AND" option: Threshold setting
Audio Output:	15 watts @ less than 3% distortion into an 8 ohm load
FCC Designation:	RC0246

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(8102) Merit.

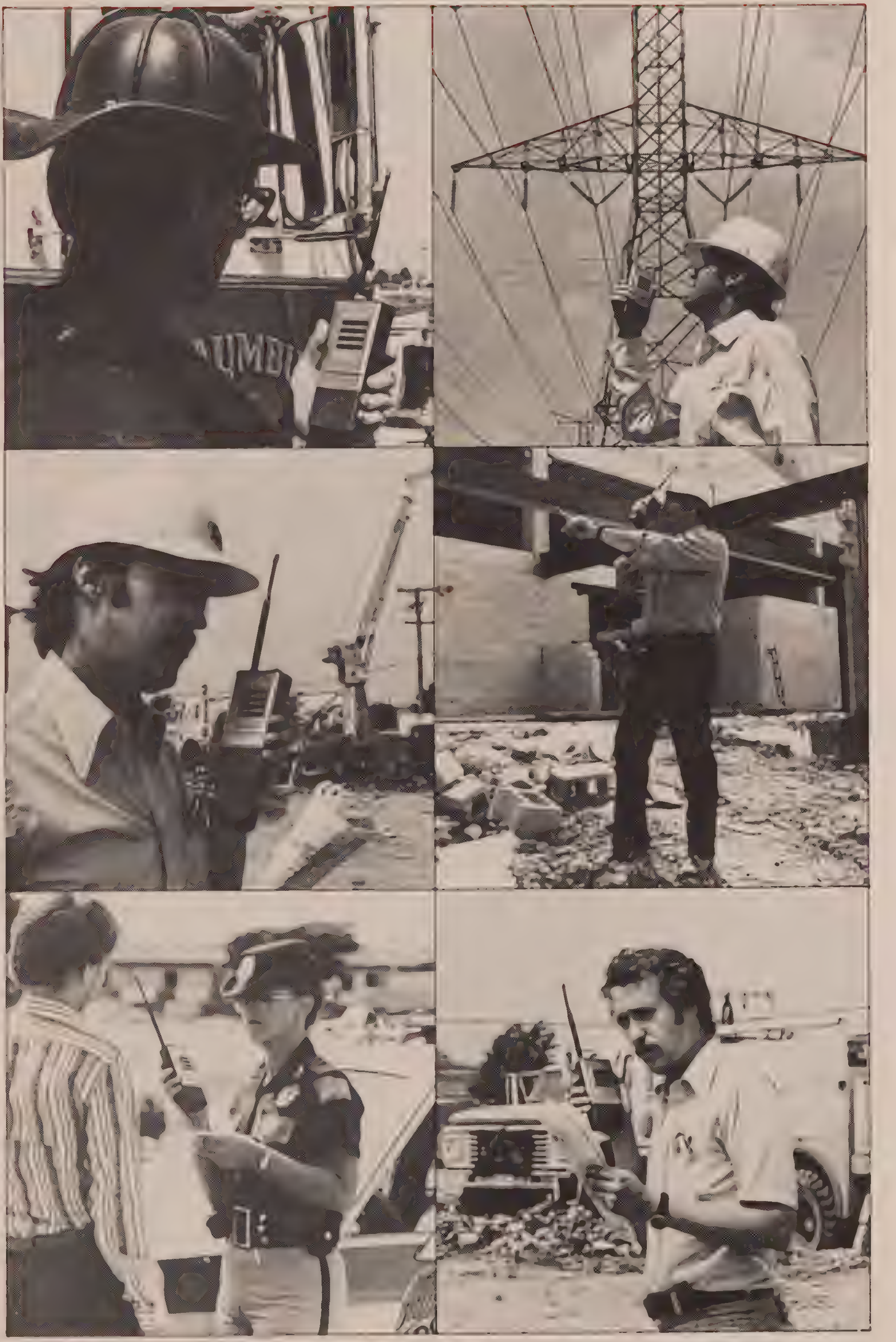
Eq. Cat.	Sec.	Item
R3	4	73

MOTOROLA

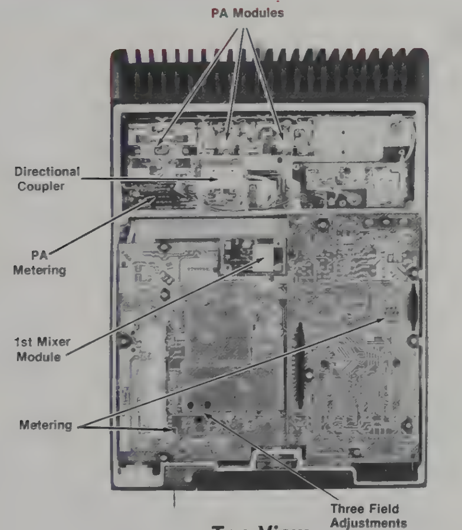
800 MHz MX 300 Series HANDIE-TALKIE

Two-way FM Portable Radio
1.5 Watts Power

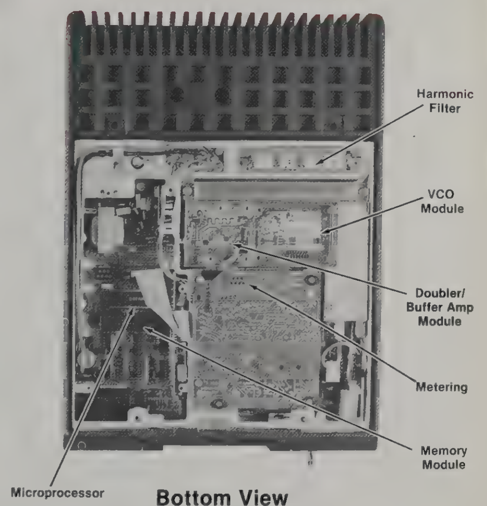
806-815 MHz (Transmitter)
851-860 MHz (Receiver)



Feature	Description	Benefits
Operator Select CHANNEL SCAN Monitoring	Pushbutton operation in SYSTEMS•S module. Radio operator manually selects from one to eight non-priority channels.	For those who prefer manual CHANNEL SCAN monitoring. Priority channels are automatically selected by the Mode Select switch.
Time-out-Timer	Programmed into the radio to automatically turn the transmitter off and provide an alert tone when transmission exceeds a preset time. Timing can be programmed for either a fixed 60 seconds. or selectable by mode in 15 second steps up to 7 minutes and 45 seconds.	Prevents lock-up of a repeater or tie-up of a channel by prolonged keying of the transmitter. Each mode can have a different time-out period to accommodate specific system requirements.
"AND" Opening Squelch	Programmed into the radio as an alternative to coded squelch controlled ''on-hook'' opening. The proper RF carrier level **and** coded squelch are required to unmute. Muted only when the proper code disappears.	Provides the pricacy and fading protection of coded squelch, yet allows operators to select the signal quality required to unmute the receiver while ''on-hook'' by using squelch setting. Can be used to eliminate messages from distant co-users having the same frequency and squelch code.



Top View



Bottom View

SYNTOR X 800 MHz FM Two-Way Radio

Performance Specifications

General

Number of Modes:	Frequency pairs are limited to five for any one licensee per FCC Rules and Regulations. One, Two, Five and Eight Mode configurations are available to accommodate Mode-Select repeater talk-around and multiple repeater selection.
Squelch Options:	''Private Line''and ''Digital Private-Line'' coded squelch are standard and available within the same radio unit. Carrier squelch and multiple coded squelch are optional
Primary Power:	± 12V dc using a DC isolated floating ground system. Radio supplied for operation with negative ground vehicles. Optional cable kit permits operation with positive gound vehicles
Radio Unit Dimensions:	2.5" H x 11.5" W x 16.0" L (63.5 mm x 292 mm x 406 mm)
Radio Unit Weight:	Approximately 22.5 Lbs. (10.2 kg). Shipping weight approximately 37 5 Lbs. (17 kg).
Metering:	A single scale 0-50 microampere meter or Motorola portable test set can be used to measure all circuits essential to checking and adjustments.

Model (Series)	Maximum Number of Modes	Frequency MHz	Minimum RF Power Output	Maximum Battery Drain (inc. std. accessories)		
				Standby @ 13.8v	Receive at Rated Audio @ 13.8v	Transmit @ Rated Power
T45VBJ	Eight	TX: 806-825 (851-870 optional) RX: 851-870	35W	0.9A	3.3A	13A
T45VCJ	Two					

Transmitter

Output Impedance:	50 ohms
Spurious and Harmonic Emissions:	More than 85 dB below carrier (for EIA spec , RS152B)
Frequency Stability:	± .0002% of assigned center frequency from −40°C to +70°C ambient (+25°C reference)
Maximum Frequency Separation:	19 MHz within each of two groupings without degradation
Modulation:	15F2 & 16F3, ±5 kHz for 100% @ 1000 Hz
Audio Sensitivity:	0.080V ±3 dB for 60% maximum deviation @ 1000 Hz
FM Hum and Noise EIA Method:	RS152B Response −50 dB Companion Rcvr Response −60 dB
Audio Response:	+1, −3 dB of 6 dB/octave pre-emphasis characteristic from 300 to 3000 Hz
Audio Distortion:	Less than 2% @ 1000 Hz, 60% maximum deviation
FCC Designation:	CC5023—Licensable under FCC rules Part 90 for 15F2, 16F3 and 16F9 emission

Receiver

Imput Impedance:	50 ohms
EIA Modulation Acceptance:	±7.0 kHz minimum
Frequency Stability:	± 0002% of assigned center frequency from −40°C to +70°C ambient (+25° reference)
Maximum Frequency Separation:	19 MHz without degradation
Sensitivity: **20 dB Quieting** **EIA SINAD**	 0.35 μV 0.25 μV
Selectivity EIA SINAD	±25 kHz: 80 dB ±100 kHz: 90 dB
Intermodulation EIA SINAD	80 dB
Spurious & Image Rejection:	100 dB
Squelch Sensitivity:	6 dBQ: 0.17 μV Carrier Squelch Threshold setting Coded Squelch: Fixed ''AND'' option: Threshold setting
Audio Output:	15 watts @ less than 3% distortion into an 8 ohm load
FCC Designation:	RC0246

Control Head

Type:	**Rotary**	**Pushbutton**
Dimensions: excluding mounting bracket	6⅞" W x 2" H x 3¾" D (175mm x 51mm x 95mm)	6⅞" W x 2¼" H x 5¾" D (175mm x 57mm x 146mm)
Weight:	1 lb. (453g)	1.5 lb. (680g)
Current Drain:	150 ma	150 ma (2 mode) 350 ma (5 mode) 500 ma (8 mode)

Speaker

Dimensions: (excluding mounting bracket)	5" x 5" x 2½" (127 mm x 63 mm)
Weight:	1.5 lbs. (680g)

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Support Services

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R3-1.1-66A

Eq Cat R3 Sec 1.1 Item 66A

MOTOROLA

SYNTOR X

800 MHz Conventional Dispatch

FM Two-Way Radio

806-870 MHz
35 watts

- TRAC-MODE Microprocessor Control with Mode-Select Operation.
- 19 MHz Frequency Separation. Transmit and Receive on any combination of 800 MHz conventional dispatch frequencies.
- Optional Repeater Talk-Around.
- Only 3 Field Adjustments For Simplified Maintenance.
- Environmentally Protected:
  —MIL STD 810C Shock, Vibration, Rain, Dust and Salt Fog
  —U.S. Forest Service Vibration
  —Twice EIA Shock Amplitude
  —Temperature Range −40°C to +70°C
- "SYSTEMS RADIO" model for sophisticated multiple mode applications.
- "COMMERCIAL RADIO" model for 1 and 2 frequency operation.

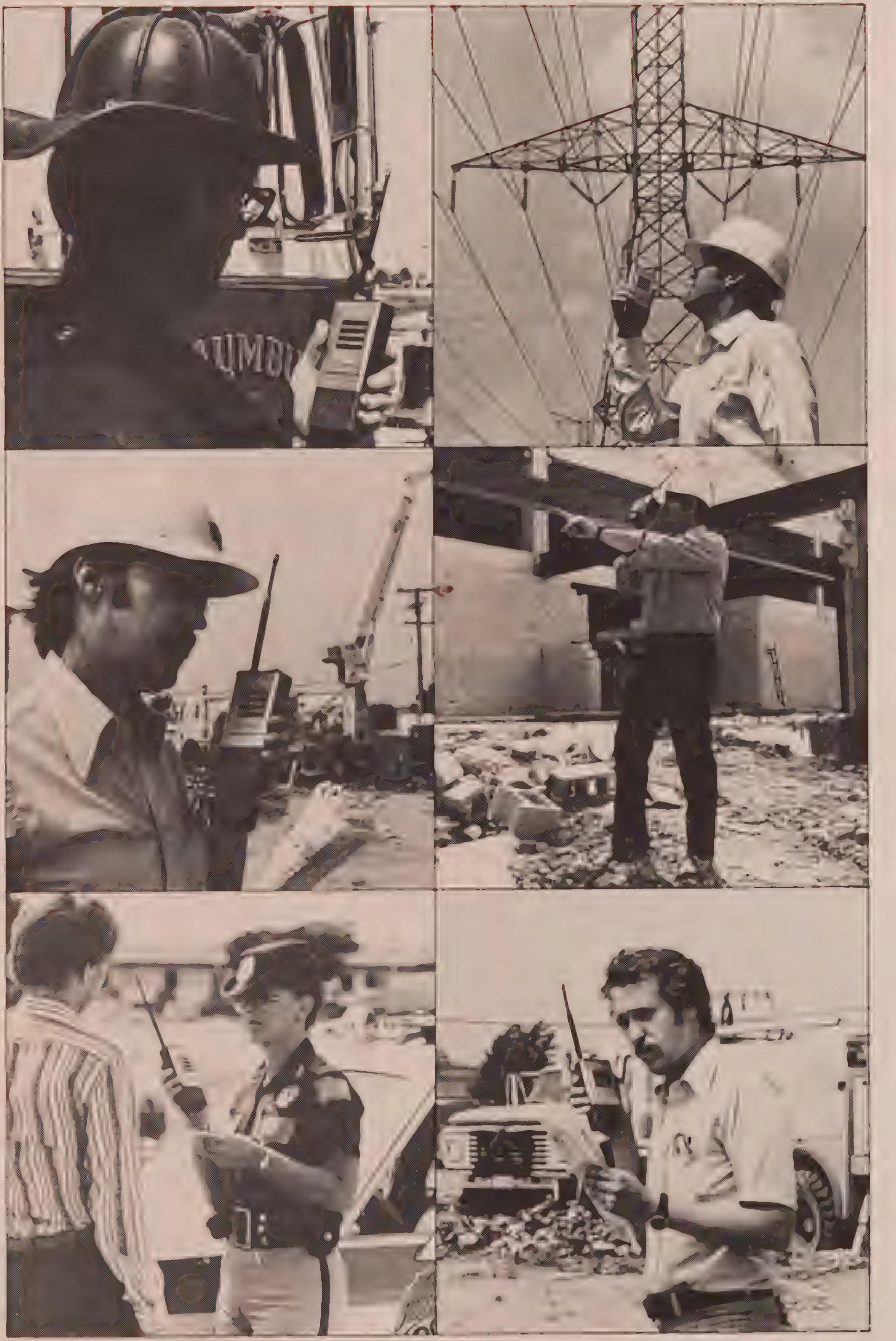
Eq. Cat.	Sec.	Item
R3	4	73

MOTOROLA

800 MHz MX 300 Series HANDIE-TALKIE

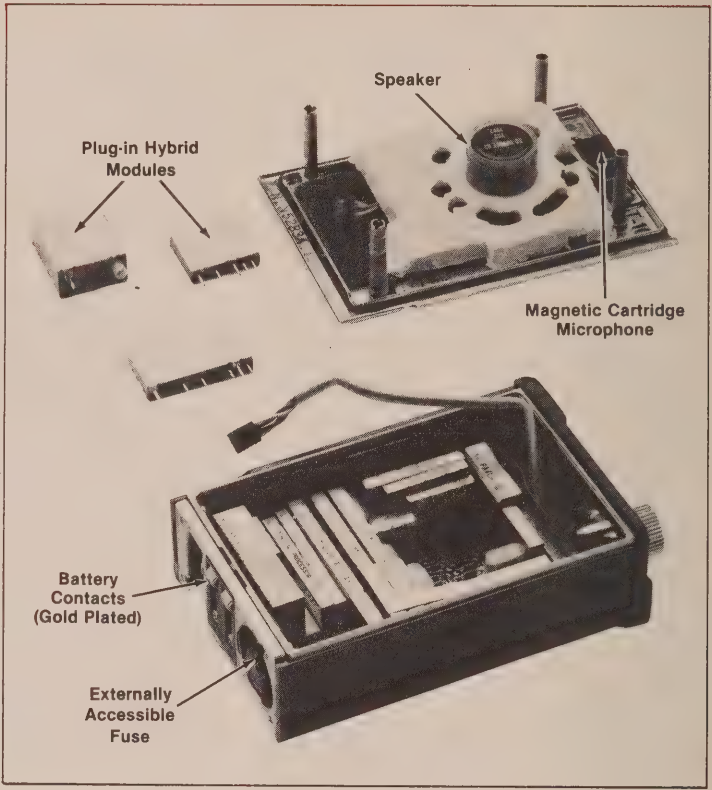
Two-way FM Portable Radio 1.5 Watts Power

806-815 MHz (Transmitter)
851-860 MHz (Receiver)



800 MHz MX 300 Series HANDIE-TALKIE Radio

MOTOROLA's MX300 Series 800 MHz portable radio offers new dimensions in portable communications. For the first time, at 800 MHz, you can communicate with a hand-held portable radio. The proven design performance of the MX300 series radios was used as a basis for this new radio. New and advanced technologies have been added, resulting in a portable radio that meets any 800 MHz conventional system communication need. A unique antenna design gives the portable radio greater antenna efficiency than conventional portable antennas. Tuning adjustments are minimal—only four are required to align the entire radio. All switching is done electronically. Performance specifications are outstanding, and up to five frequencies are available. Repeater Talkaround is a standard option, giving you optimum communications flexibility.



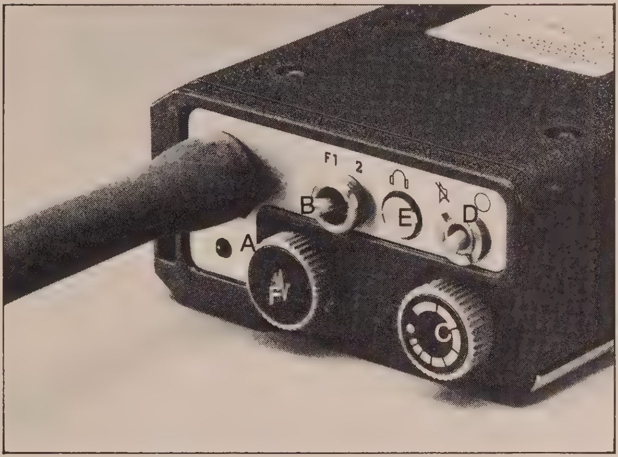
- 1.5 watt RF output
- Five channel capability
- Wide space transmit and receive
- Advanced antenna design
- Repeater talkaround capability
- FM approved
- Plug-in hybrid modules and channel elements
- Weather sealed P-T-T switch
- Transmit light/battery Status indicator
- Externally accessible fuse
- Speaker and antenna jacks
- Quick release batteries in four sizes
- Universal and CONVERTA-COM capability
- Wide range of options and accessories

	FEATURES	BENEFITS
• **Electronic Switching**	Switching of DC and RF for transmit and receive functions is done by solid state electronic modules.	Eliminates mechanical failures, improves reliability and minimizes down time.
• **Minimum Adjustments**	Only one adjustment (frequency) is required to align the entire receiver. Three adjustments (I.D.C., frequency and power) completely align the entire transmitter.	Results in optimum performance, and greatly reduces time required to service your portable.
• **Advanced Antenna Design**	Maximum power output is achieved, improving coverage. In addition, receiver performance is improved providing more effective and dependable communications.	Portable radio performance is optimized, providing greater communication coverage.
• **Repeater Talkaround (Option)**	The first 800 MHz portable to offer talkaround capability for those who meet FCC requirements.* Any channel can be switched to this talkaround feature. The multi-frequency models with this option use internal squelch.	Greater flexibility, portable-to-portable, is achieved without tying up your repeater station, and in case of repeater failure you can still communicate.
• **Wide Space Transmit and Receive**	As a standard feature, the unique design of the MX300 Series radio allows transmitter frequency separations across the entire band.	This capability provides a wide selection of channel configurations to accommodate numerous frequency requirements, resulting in greater system flexibility.

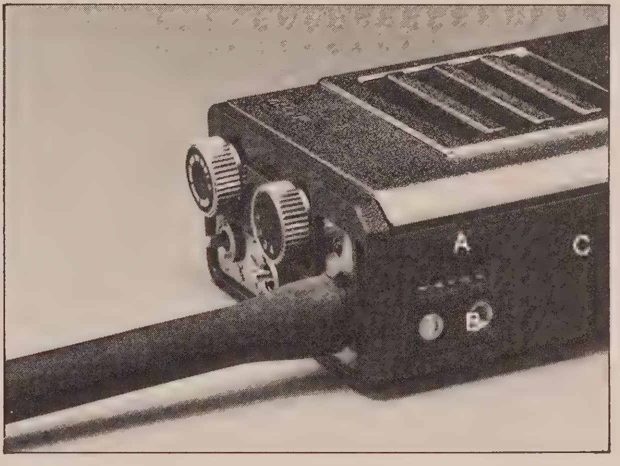
*User must have exclusive use of channel and be licensed for Talkaround.

Controls and Accessory Connectors

As shown in the adjacent photograph, the controls are conveniently top-mounted. In addition to the earpiece jack and LED battery status indicator, the dual function, light emitting diode (LED) activates during transmission and allows the user to monitor the battery condition. The push-to-talk switch, accessory connector and external antenna jack are located on the side of the radio. The accessory connector accepts remote speaker/microphones and other accessories with a simple, plug-in procedure.



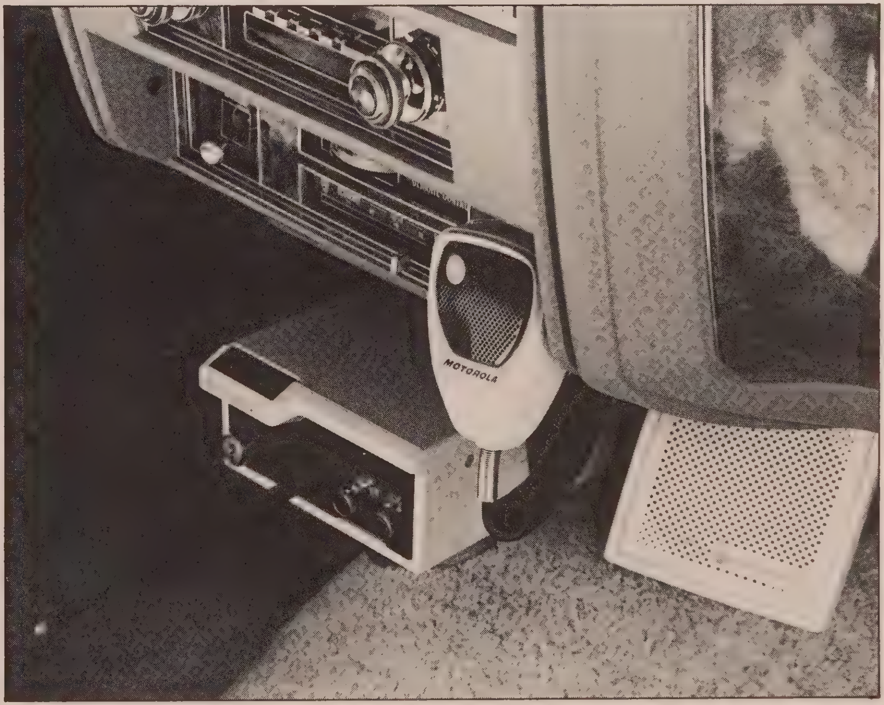
A LED Battery Status Indicator
B Frequency Selector
C On/Off Volume Control
D PRIVATE-LINE AND DIGITAL PRIVATE-LINE Disable Switch
E Speaker/Headphone Jack
F Squelch Control



A Accessory Connector (Gold Plated)
B External Antenna Jack
C Push-to-Talk Switch

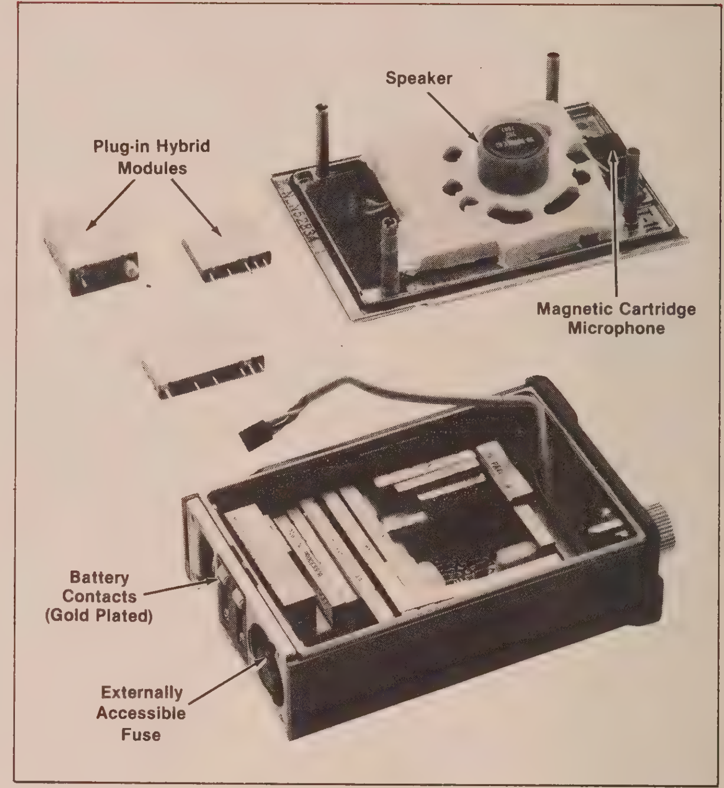
Other Options and Accessories

Options:
Repeater Talkaround
Time-Out-Timer (30 seconds)
Selective Call
Sure Grip, Tall Controls
Shadow Bronze Front Cover
Audio Accessories:
Remote Speaker/Microphone
  Coil Cord
  Straight Cord
Noise Cancelling Headset Microphone
Safety Helmet Headset
Earpiece, W/O Volume Control
Earpiece Headset Microphone
CONVERTA-COM Console
Carrying Accessories:
Belt Clip Back Cover
Wrist Strap
Belt
Chest Pack
Swivel Carry Holder
Leather Carrying Cases



800 MHz MX 300 Series HANDIE-TALKIE Radio

MOTOROLA's MX300 Series 800 MHz portable radio offers new dimensions in portable communications. For the first time, at 800 MHz, you can communicate with a hand-held portable radio. The proven design performance of the MX300 series radios was used as a basis for this new radio. New and advanced technologies have been added, resulting in a portable radio that meets any 800 MHz conventional system communication need. A unique antenna design gives the portable radio greater antenna efficiency than conventional portable antennas. Tuning adjustments are minimal—only four are required to align the entire radio. All switching is done electronically. Performance specifications are outstanding, and up to five frequencies are available. Repeater Talkaround is a standard option, giving you optimum communications flexibility.



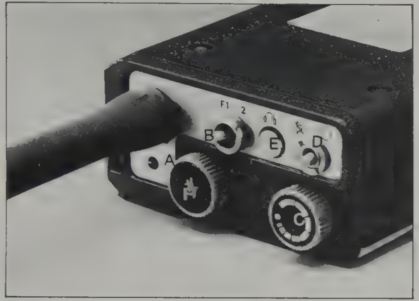
- 1.5 watt RF output
- Five channel capability
- Wide space transmit and receive
- Advanced antenna design
- Repeater talkaround capability
- FM approved
- Plug-in hybrid modules and channel elements
- Weather sealed P-T-T switch
- Transmit light/battery Status indicator
- Externally accessible fuse
- Speaker and antenna jacks
- Quick release batteries in four sizes
- Universal and CONVERTA-COM capability
- Wide range of options and accessories

	FEATURES	BENEFITS
• **Electronic Switching**	Switching of DC and RF for transmit and receive functions is done by solid state electronic modules.	Eliminates mechanical failures, improves reliability and minimizes down time.
• **Minimum Adjustments**	Only one adjustment (frequency) is required to align the entire receiver. Three adjustments (I.D.C., frequency and power) completely align the entire transmitter.	Results in optimum performance, and greatly reduces time required to service your portable.
• **Advanced Antenna Design**	Maximum power output is achieved, improving coverage. In addition, receiver performance is improved providing more effective and dependable communications.	Portable radio performance is optimized, providing greater communication coverage.
• **Repeater Talkaround (Option)**	The first 800 MHz portable to offer talkaround capability for those who meet FCC requirements.* Any channel can be switched to this talkaround feature. The multi-frequency models with this option use internal squelch.	Greater flexibility, portable-to-portable, is achieved without tying up your repeater station, and in case of repeater failure you can still communicate.
• **Wide Space Transmit and Receive**	As a standard feature, the unique design of the MX300 Series radio allows transmitter frequency separations across the entire band.	This capability provides a wide selection of channel configurations to accommodate numerous frequency requirements, resulting in greater system flexibility.

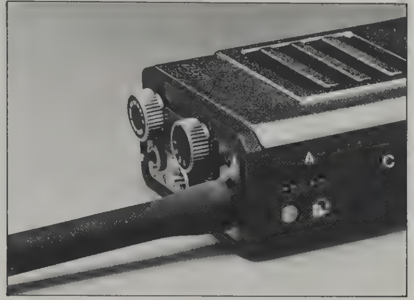
*User must have exclusive use of channel and be licensed for Talkaround.

Controls and Accessory Connectors

As shown in the adjacent photograph, the controls are conveniently top-mounted. In addition to the earpiece jack and LED battery status indicator, the dual function, light emitting diode (LED) activates during transmission and allows the user to monitor the battery condition. The push-to-talk switch, accessory connector and external antenna jack are located on the side of the radio. The accessory connector accepts remote speaker/microphones and other accessories with a simple, plug-in procedure.



A LED Battery Status Indicator
B Frequency Selector
C On/Off Volume Control
D PRIVATE-LINE AND DIGITAL PRIVATE-LINE Disable Switch
E Speaker/Headphone Jack
F Squelch Control



A Accessory Connector (Gold Plated)
B External Antenna Jack
C Push-to-Talk Switch

Other Options and Accessories

Options:
Repeater Talkaround
Time-Out-Timer (30 seconds)
Selective Call
Sure Grip, Tall Controls
Shadow Bronze Front Cover
Audio Accessories:
Remote Speaker/Microphone
  Coil Cord
  Straight Cord
Noise Cancelling Headset Microphone
Safety Helmet Headset
Earpiece, W/O Volume Control
Earpiece Headset Microphone
CONVERTA-COM Console
Carrying Accessories:
Belt Clip Back Cover
Wrist Strap
Belt
Chest Pack
Swivel Carry Holder
Leather Carrying Cases

800 MHz MX 300 Series HANDIE-TALKIE Radio

Performance Specifications

Model Series: H35AAU

Frequency Range: TX 806-815 MHz; RX 851-860 MHz. Also, TX/RX 851-860 MHz with option H560.

Power Supply: One rechargeable nickel-cadmium battery.

Size: 2.84″ wide × 1.41″ deep × (see chart below)″ high (72 mm × 36 mm × [see chart below] mm)

	MX 320 Housing	MX 330 Housing	MX 340 Housing	MX 350 Housing
Radio Only (Height)	4.20″ (107 mm)	4.59″ (117 mm)	4.98″ (126 mm)	5.76″ (146mm)
Battery Only (Height)	**Radio with Battery (Height)**			
Light Capacity (1.47″)* (37 mm)	5.67″ (144 mm)	6.06″ (154 mm)	6.45″ (163 mm)	7.23″ (183 mm)
Medium Capacity (1.83″)* (47 mm)	6.03″ (154 mm)	6.42″ (164 mm)	6.81″ (173 mm)	7.59″ (193 mm)
High Capacity (3.40″)* (87 mm)	7.60″ (194 mm)	7.99″ (204 mm)	8.38″ (213 mm)	9.16″ (233 mm)
Ultra High Capacity (4.45″)* (113 mm)	8.64″ (220 mm)	9.03″ (230 mm)	9.42″ (239 mm)	10.20″ (259 mm)

*Height of Battery Only.

Weight:

Radio Only (Average)

A C1R1, carrier squelch, 1.5 watt radio weighs 14 ounces (385g)

For PRIVATE-LINE squelch add 0.5 ounce (15g).*

For DIGITAL PRIVATE-LINE squelch add 0.5 ounces (15g).*

For additional channels add 0.5 ounce (15g) per channel.*

For option H560 add 0.3 ounce (9g).

*Add Weights to Basic Radio Weight 14.0 ounces (385g).

Batteries Only

Rapid Charge Batteries
Light Capacity 5.2 oz. (147g)
Medium Capacity 7.3 oz. (207g)
High Capacity 14.1 oz. (399g)
Ultra High Capacity 19.4 oz. (550g)

Transmitter

RF Power Output—NICAD Battery:	1.5W
Frequency Stability—(−30° C to +60° C; +25° C Ref):	±.00025%
Modulation:	16F3
FM Noise:	−60 dB
Audio Response—(6 dB/octave pre-emphasis from 300 to 3000 Hz):	+1, −3 dB
Audio Distortion—(at 1000 Hz, 3 kHz deviation):	3%
Spurious Emissions: **Harmonics:**	−59 dB −46 dB
Frequency Separation: (No Degradation)	Entire Range
FCC Designation:	1000 & 3000 Series Models—CC5024 6000 Series Models—CC5025

Receiver

Channel Spacing:	25 kHz
Modulation Acceptance:	±7.5 kHz
Sensitivity—	
20 dB Quieting:	.5 µV
12 dB SINAD:	.35 µV
Squelch/Paging:	.25 µV
Selectivity:	75 dB
Frequency Separation: (No Degradation)	9 MHz
Intermodulation:	65 dB
Frequency Stability—(−30° C to +60° C; +25° C Ref):	±.0002%
Spurious Rejection:	
Image and ½ I.F.:	55 dB minimum
All others:	70 dB minimum
Audio Output: (at less than 5% distortion)	500 mW
FCC Designation:	RC0250

MOTOROLA
Communications and Electronics Inc.

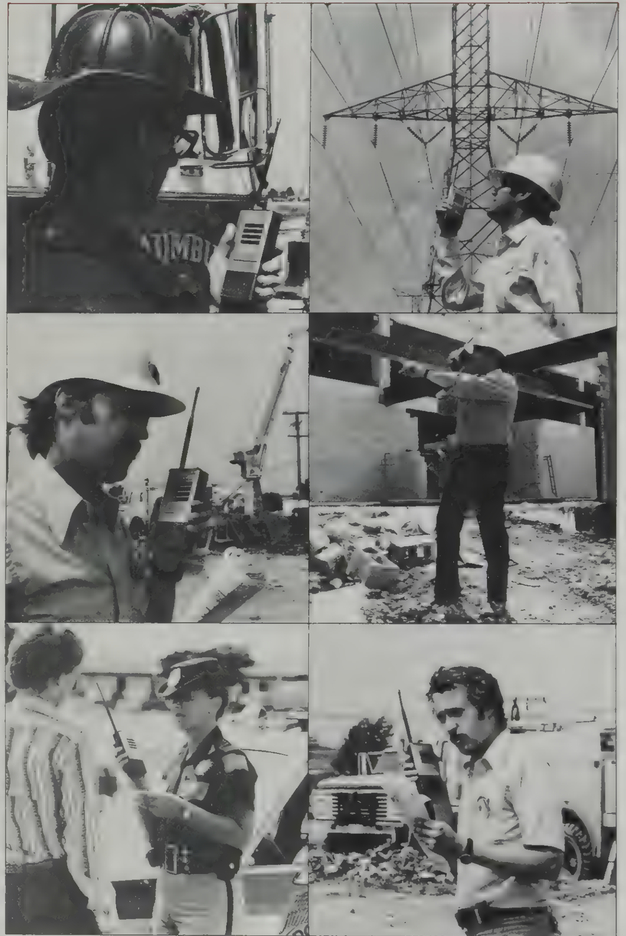
A Subsidiary of Motorola, Inc
1301 East Algonquin Rd., Schaumburg, Illinois 60196
(312) 397-1000

Specifications subject to change without notice.

MOTOROLA

800 MHz MX 300 Series HANDIE-TALKIE

Two-way FM Portable Radio
1.5 Watts Power
806-815 MHz (Transmitter)
851-860 MHz (Receiver)



800 MHz MX 300 Series HANDIE-TALKIE Radio

Performance Specifications

Model Series:	H35AAU
Frequency Range:	TX 806-815 MHz; RX 851-860 MHz. Also, TX/RX 851-860 MHz with option H560.
Power Supply:	One rechargeable nickel-cadmium battery.
Size:	2.84″ wide × 1.41″ deep × (see chart below)″ high (72 mm × 36 mm × [see chart below] mm)

	MX 320 Housing	MX 330 Housing	MX 340 Housing	MX 350 Housing
Radio Only (Height)	4.20″ (107 mm)	4.59″ (117 mm)	4.98″ (126 mm)	5.76″ (146mm)
Battery Only (Height)	Radio with Battery (Height)			
Light Capacity (1.47″)* (37 mm)	5.67″ (144 mm)	6.06″ (154 mm)	6.45″ (163 mm)	7.23″ (183 mm)
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Radio Only (Average)

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For DIGITAL PRIVATE-LINE squelch add 0.5 ounces (15g).*

For additional channels add 0.5 ounce (15g) per channel.*

For option H560 add 0.3 ounce (9g).

*Add Weights to Basic Radio Weight 14.0 ounces (385g).

Batteries Only

Rapid Charge Batteries

Light Capacity 5.2 oz. (147g)
Medium Capacity 7.3 oz. (207g)
High Capacity 14.1 oz. (399g)
Ultra High Capacity 19.4 oz. (550g)

Transmitter

RF Power Output—NICAD Battery:	1.5 W
Frequency Stability—(−30° C to +60° C; +25° C Ref):	±.00025%
Modulation:	16F3
FM Noise:	−60 dB
Audio Response—(6 dB/octave pre-emphasis from 300 to 3000 Hz):	+1, −3 dB
Audio Distortion—(at 1000 Hz, 3 kHz deviation):	3%
Spurious Emissions:	−59 dB
Harmonics:	−46 dB
Frequency Separation: (No Degradation)	Entire Range
FCC Designation:	1000 & 3000 Series Models—CC5024 6000 Series Models—CC5025

Receiver

Channel Spacing:	25 kHz
Modulation Acceptance:	±7.5 kHz
Sensitivity—	
20 dB Quieting:	.5 μV
12 dB SINAD:	.35 μV
Squelch/Paging:	.25 μV
Selectivity:	75 dB
Frequency Separation: (No Degradation)	9 MHz
Intermodulation:	65 dB
Frequency Stability—(−30° C to +60° C; +25° C Ref):	±.0002%
Spurious Rejection:	
Image and ½ I.F.:	55 dB minimum
All others:	70 dB minimum
Audio Output: (at less than 5% distortion)	500 mW
FCC Designation:	RC0250

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Specifications subject to change without notice.

MOTOROLA

800 MHz MX300 Series
Vehicular Power Amplifier and CONVERTA-COM Mobile Radio Console
Power Amplifier Range from 806 - 870 MHz

POWER AMPLIFIER FEATURES:

- 15 Watts Power Output
- Small Size and Lightweight
- Broadband Design
- Thermal Cutoff Protection
- Mobile Duty Cycle
- Compatible with Negative or Positive Ground
- Operates in conjunction with 1.5 Watt Portable Power
- Compatible with MX300 Series CONVERTA-COM Mobile Systems

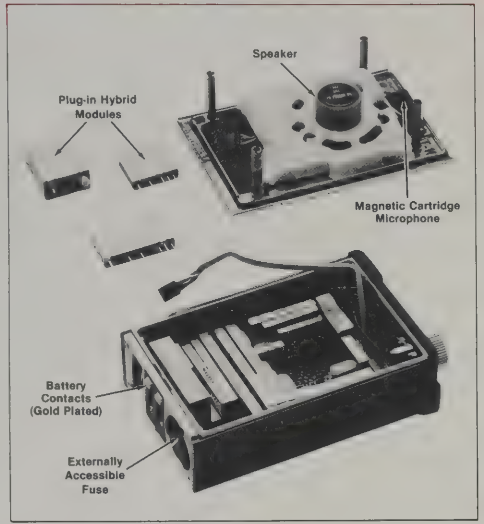
"CONVERTA-COM" MOBILE CONSOLE FEATURES:

- Accepts All MX300 Series 800 MHz Models
- Fast, 3-Hour Charge Rate
- Charge/Transmit Indicator Light
- External Speaker (½ Watt and 12 Watt audio)
- Key Lock
- Ignition Switch Interlock
- Front Panel/Control Illumination
- Tamper-Resistant Universal Mounting
- Dead Battery Radio Operation
- Rugged Construction
- Compatible with 800 MHz MX300 Series Power Amplifier

800 MHz MX 300 Series HANDIE-TALKIE Radio

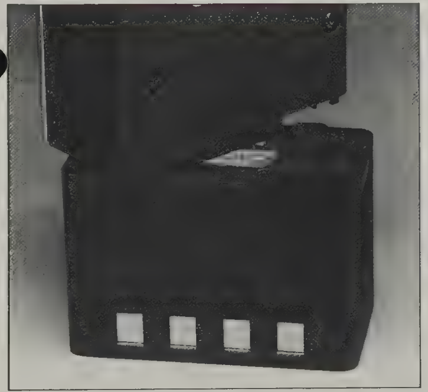
MOTOROLA's MX300 Series 800 MHz portable radio offers new dimensions in portable communications. For the first time, at 800 MHz, you can communicate with a hand-held portable radio. The proven design performance of the MX300 series radios was used as a basis for this new radio. New and advanced technologies have been added, resulting in a portable radio that meets any 800 MHz conventional system communication need. A unique antenna design gives the portable radio greater antenna efficiency than conventional portable antennas. Tuning adjustments are minimal—only four are required to align the entire radio. All switching is done electronically. Performance specifications are outstanding, and up to five frequencies are available. Repeater Talkaround is a standard option, giving you optimum communications flexibility.

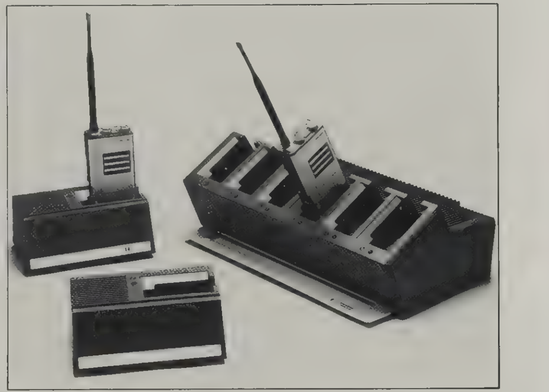
- 1.5 watt RF output
- Five channel capability
- Wide space transmit and receive
- Advanced antenna design
- Repeater talkaround capability
- FM approved
- Plug-in hybrid modules and channel elements
- Weather sealed P-T-T switch
- Transmit light/battery Status indicator
- Externally accessible fuse
- Speaker and antenna jacks
- Quick release batteries in four sizes
- Universal and CONVERTA-COM capability
- Wide range of options and accessories



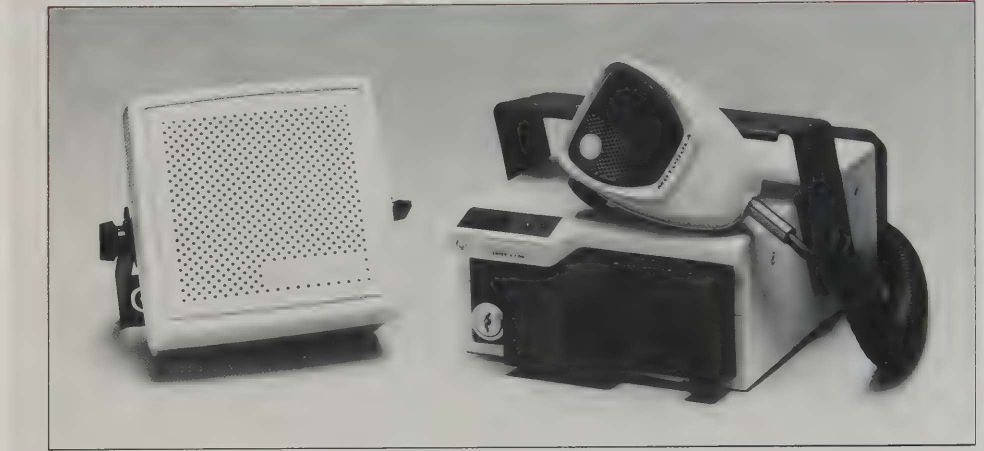
	FEATURES	BENEFITS
Electronic Switching	Switching of DC and RF for transmit and receive functions is done by solid state electronic modules.	Eliminates mechanical failures, improves reliability and minimizes down time.
Minimum Adjustments	Only one adjustment (frequency) is required to align the entire receiver. Three adjustments (I.D.C., frequency and power) completely align the entire transmitter.	Results in optimum performance, and greatly reduces time required to service your portable.
Advanced Antenna Design	Maximum power output is achieved, improving coverage. In addition, receiver performance is improved providing more effective and dependable communications.	Portable radio performance is optimized, providing greater communication coverage.
Repeater Talkaround (Option)	The first 800 MHz portable to offer talkaround capability for those who meet FCC requirements.* Any channel can be switched to this talkaround feature. The multi-frequency models with this option use internal squelch.	Greater flexibility, portable-to-portable, is achieved without tying up your repeater station, and in case of repeater failure you can still communicate.
Wide Space Transmit and Receive	As a standard feature, the unique design of the MX300 Series radio allows transmitter frequency separations across the entire band.	This capability provides a wide selection of channel configurations to accommodate numerous frequency requirements, resulting in greater system flexibility.

	FEATURES	BENEFITS
Plug-in Hybrid Modular Components	A minimum of 18 plug-in hybrid modules are used in these radios, representing over 90% of the electronics. Gold-plated contact pins and printed circuit board sockets are keyed to prevent incorrect insertion of modules, and ensure reliable module connection. A multi-layer printed circuit board minimizes the need to cross circuits and eases the crowding of conducting paths. A special flex circuit is also used to eliminate broken, frayed or tangled wires.	This latest module design, combined with the multi-layer printed circuit board and flex circuit, provides the ultimate in durability and fast, reliable maintenance.
Coded Squelch Systems	Users now have the choice of utilizing DIGITAL PRIVATE-LINE (DPL) or PRIVATE-LINE (PL) coded squelch systems. For the first time, DIGITAL PRIVATE-LINE is available in an MX320 housing. DPL offers 80 new, unique codes to insure the effectiveness of your system for years to come.	Coded squelch systems reduce co-channel interference and operator fatigue in addition to eliminating "squelch tail" annoyance.





Quick Release Battery	A choice of 4 battery capacities are available depending upon system requirements. A two point locking assembly securely attaches the battery to the radio housing. Removal of the battery is accomplished by depressing the lock mechanism on the side of the radio and twisting the battery one-quarter turn.	This unique design eliminates the need for special tools or coins for removing the battery and provides easy battery replacement.
Battery Chargers	Single unit and multiple unit (6 compartment) chargers are available in one* and 14 hour charge rates.	These units will charge either the complete radio or the battery alone. Indicator lights are provided on each unit to inform the user of charging status.



Options and Accessories

	FEATURES	BENEFITS
CONVERTA-COM Mobile Radio Console	The CONVERTA-COM Console converts the dependable, high performance MX300 Series portable radio to a mobile radio whenever the user is in his vehicle. The mobile microphone, speaker, antenna, and charger are connected automatically upon insertion of the portable into the console.	Enables portable radio to work as a mobile radio. The mobile console automatically recharges the portable battery.
Carry Holders and Leather Cases	A uniquely designed carry holder is shipped standard with all package model radios. This small, lightweight plastic holder fastens to any belt (up to 2½ inches wide) and securely holds the radio in place, yet allows easy removal of the unit. A variety of leather carrying cases are available for different needs. Standard belt loop cases with snap-on perforated full covers provide maximum protection, yet permits audio to be heard clearly. T-strap covers permit easy access to controls. Swivel cases attach to the belt loop attachment by inverting the case.	Provides a wide variety of convenient methods for the user to carry or wear the radio.

Factory Mutual Approval Information

All standard 800 MHz MX 300 Series radios, when ordered with the NLN8834B and NLN8840A batteries, are approved by Factory Mutual as intrinsically safe for use in Classes I and II, Divisions 1 and 2, Groups C, D, E, F and G atmospheres and when ordered with the NLN8835B, NLN8841A batteries for Classes I and II, Divisions 1 and 2, Groups D, F and G atmospheres.

The 800 MHz radio is also approved non-incendive for Class I, Division 2, Groups A, B, C and D when used with the NLN8834B, NLN8835B, NLN8840A and NLN8841A batteries. Maximum operating temperature is—T4A.

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*User must have exclusive use of channel and be licensed for Talkaround.

*The ultra high capacity battery recharges in 2 hours in the 1 hour charger only.

MOTOROLA

800 MHz MX300 Series Vehicular Power Amplifier and CONVERTA-COM Mobile Radio Console

Power Amplifier Range from 806 - 870 MHz

POWER AMPLIFIER FEATURES:

- 15 Watts Power Output
- Small Size and Lightweight
- Broadband Design
- Thermal Cutoff Protection
- Mobile Duty Cycle
- Compatible with Negative or Positive Ground
- Operates in conjunction with 1.5 Watt Portable Power
- Compatible with MX300 Series CONVERTA-COM Mobile Systems

"CONVERTA-COM" MOBILE CONSOLE FEATURES:

- Accepts All MX300 Series 800 MHz Models
- Fast, 3-Hour Charge Rate
- Charge/Transmit Indicator Light
- External Speaker (½ Watt and 12 Watt audio)
- Key Lock
- Ignition Switch Interlock
- Front Panel/Control Illumination
- Tamper-Resistant Universal Mounting
- Dead Battery Radio Operation
- Rugged Construction
- Compatible with 800 MHz MX300 Series Power Amplifier

MX300 Series Power Amplifier and CONVERTA-COM Mobile Console.

The MX300 series CONVERTA-COM mobile radio console is a perfect complement to your 800 MHz MX300 portable radio. In addition to the convenient, flexible use of a hand-held portable radio when away from your vehicle, you can also enjoy the versatility of mobile operation and extended range provided by the 800 MHz vehicular power amplifier.

CONVERTA-COM Mobile Radio Console

FEATURE	DESCRIPTION	BENEFITS
Universal Model Compatibility	The mobile console is designed to accommodate the 800 MHz MX300 radio units with options such as belt-clip back cover, CHANNEL SCAN, Unit I.D. and Emergency, and TOUCH-CODE radio signalling.	Regardless of size or options, the 800 MHz MX300 portable radio will be securely held in the console.
Automatic Connection	The 800 MHz MX300 portable radio has a specially designed multi-function side connector. When the radio is inserted into the CONVERTA-COM mobile console, the internal transfer circuitry of this side connector provides automatic connection to a palm microphone and optional mobile speaker. At the same time, the mobile console provides automatic connection to the mobile antenna and to the battery charging circuitry.	Inserting the 800 MHz MX300 portable radio into the CONVERTA-COM mobile console automatically puts the radio into the mobile mode. You gain the convenience, features, and benefits of mobile operation.
Fast Charging	The CONVERTA-COM mobile console instantaneously begins to recharge the portable radio battery upon insertion.	Even if your radio's nickel-cadmium battery has depleted its power, it will be fully charged in just three hours.
Dead Battery Operation	The portable radio gets its power from both the vehicle's battery and the radio's battery.	Regardless of your radio battery condition, you get immediate RF communications when the portable radio is placed into the CONVERTA-COM mobile console. There's no waiting for the radio battery to recharge.
Indicator Lights	Two indicator lights are provided on the console.	A green light indicates that the radio battery is charging. A red light illuminates when you are transmitting.
Front Panel/Control Illumination	An integral light is located above the front panel of the console.	The light increases your visability at night, provides easy identification of controls, and illuminates the radio pocket location for ease of insertion.
Ignition Switch Interlock	The CONVERTA-COM mobile console functions can be linked to the vehicle's ignition switch.	This feature prevents unauthorized use of the radio when you are away from the vehicle. It also avoids excessive drain on the vehicle's battery by preventing battery charger operation. This is especially important during prolonged periods of vehicle inactivity such as weekends.

FEATURE	DESCRIPTION	BENEFITS
Key Lock Safety	All consoles have a key lock which is mounted within the push-button release.	Radio theft is greatly minimized by this standard feature. When unlocked, the push-button is used to eject the radio out of the console far enough to be easily removed for portable use.
Rugged Construction	The console is small and lightweight and is constructed of high impact materials.	The console will withstand the shock and vibration inherent to vehicular use. Long life and consistent, top mobile-type performance is assured with this rugged unit.
Tamper-Proof Universal Mounting	The CONVERTA-COM mobile console's mounting bracket is fastened under the dashboard with special mounting screws. Tamper-resistant hexagonal mounting screws pass through the universal trunnion bracket into the console housing. An adapter bracket is also available if hump mounting of the console is desired.	These security measures deter unauthorized removal of the CONVERTA-COM mobile console.

OPTIONS	DESCRIPTION	BENEFITS
External Speaker	You can select a mobile type speaker with either ½-watt output or a powerful 12-watt output speaker/amplifier. The 12-watt speaker/amplifier option includes an independent volume control on the console panel that enables you to select the desired audio level regardless of the volume setting on the radio itself.	These speakers give you loud and clear mobile-like audio. The 12-watt speaker/amplifier with its increased audio output is especially beneficial for those vehicles which have a high ambient noise level.

800 MHz Vehicular Power Amplifier

FEATURE	DESCRIPTION	BENEFITS
Increased Power	Provides 15 watts of power in the 800 MHz band.	Additional power to increase range of your portable system while in your vehicle and insure clear transmission in fringe areas.
800 MHZ MX300 Series Models	FCC type accepted with ±.000 25% transmit stability 800 MHz band MX300 radio, and CONVERTA-COM Radio Systems.	MX300 Series 800 MHz Power Amplifier may be added to these existing CONVERTA-COM Radio Systems.
Small Size and Lightweight	Reliable power comes in a small package that can be readily installed.	Designed to mount under the CONVERTA-COM console for user convenience. A dash or under seat mounting kit is also available.
Broadband Design	Factory tuned to operate across the entire 800 MHz bandsplit, including talkaround.	Capable of full performance operation with standard frequency separation. No tuning adjustments required.
Positive or Negative Ground	The unit is designed for use in either positive or negative ground vehicles, and has reverse polarity protection.	The amplifier may be installed in any 12-volt vehicle. It is impossible to damage the unit by reversing connections to the power source.
Mobile Duty Cycle	The MX300 Series Radio 800 MHz Power Amplifier meets or exceeds all EIA mobile standards including a 20% duty cycle (1 minute on, 4 minutes off).	Designed with top performance specifications for dependable full-time operation.
Thermal Cutback Protection	Internal thermistor reduces power of the power amplifier in case of overheating.	Long life is assured by protection against burnout and overheating.
Operates with 1.5 Watts of Portable Power	One and a half watts of portable power will drive the power amplifier to varying levels of power output. (See specifications).	Functions with all normal portable power levels.
Ease of Servicing	The only disassembly required for servicing is removal of the dust cover. All parts are then easily accessible. The in-line fuse is readily replaced. The power amplifier never requires tuning.	Servicing is a simple matter so that the MX300 Series 800 MHz Power Amplifier stays on the job, not on the bench.

800 MHz Vehicular Power Amplifier and CONVERTA-COM Mobile Radio Console

Performance Specifications

MX300 Mobile Console

Model:	N1244	
Dimensions: **(L x H x W in inches)**	3.00 x 6.10 x 7.0 (76 x 155 x 178 mm)	
Weight:	2.25 lbs. (1021 g) w/o portable radio	
Nominal Input Voltage:	13.8V dc, neg. or pos. ground	
Current Drain Radio in Console	Battery Charged	Battery Discharged
Standby:	.2A	.8A
Transmit:	1.7A	1.7A
Receive:		
.5W Internal:	.2A	.8A
.5W External:*	.2A	.8A
12W External:*	1.6A	2.2A
Charge Rate:	3 hrs. (rapid charge battery) 14 hrs. (standard charge battery)	
Antenna Input Impedance:	50 Ohms	
Audio Output: **(at less than 5% distortion)**	500 mW internal 500 mW external* 12W external*	

*Optional

800 MHz Vehicular Power Amplifier

Model:	N1273
Frequency:	800-870 MHz
RF Power Output:	15 Watts minimum with 1.5 Watts drive
Input Drive Acceptance at PA Port:	1.5 to 2.5 Watts
Operating Voltage:	13.6 VDC Nominal, neg. or pos. grd.
Operating Temperature:	−30°C to +60°C (+25° reference)
Duty Cycle:	Exceeds EIA RS152B Mobile Standards
Receiver Insertion Loss:	1.5 dB maximum (includes 0.5 dB for 12 inch interconnect cable)
Spurious Emissions: **(below carrier)**	≤−59 dB
Current Drain–	
Transmit:	≤ 8 Amps Nominal
Standby:	≤ 50 mA
FCC Designation:	FCC ID: AZ489FC5032
Type Acceptance:	FCC Parts 81 & 90. Selected MX300 radio models, also approved under Part 22.
Dimensions:	2.25 in. H x 6.75 in. W x 6.4 in. D (97.2 cubic inches) (57.2 mm x 171.5 mm x 162.6 mm)
Weight:	1.8 lbs. (818g)

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Communications
SERVICE

Support Services
Wherever Motorola sells, our product is backed by service. In the U.S., we have 900 authorized or company-owned stations. In addition, our products are serviced throughout the world by a wide network of company or authorized independent distributor service organizations.

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R3-5-84

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DIMENSION IV

Tone and Voice Radio Pager

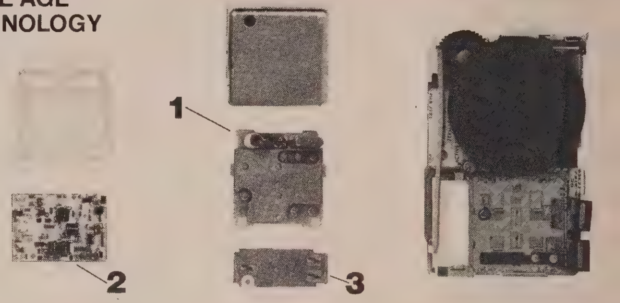
851-866 MHz
a People Finder radio pager

- **Revolutionary Space Age Technology**
- **Rugged Construction**
- **Convenient Pager Controls**
- **Loud Audio Output**
- **Single Battery Operation**

DIMENSION IV 800 MHz Tone and Voice Pager

Revolutionary, space-age technology makes the DIMENSION IV 800 MHz Tone and Voice pager a true leadership product. It's the first of its kind — the only 800 MHz paging product on the market today. With the introduction of this pager, Motorola leads the way in supplying total communication systems at 800 MHz. The advanced technology of this pager adds up to improved serviceability and greater reliability. The DIMENSION IV 800 MHz pager features the same ruggedness, superb audio output and exceptional performance found in lower band DIMENSION IV pagers. This new pager is compatible with the existing 800 MHz base station equipment and the existing encoding devices. Save time by staying in touch and on top with the new DIMENSION IV 800 MHz radio pager.

SPACE AGE TECHNOLOGY



Features	Description	Benefits
Space Age Technology	Modular design	Means fewer external parts and greater serviceability.
	Computer controlled laser tuning of the entire front end	The radio frequency circuits are permanently tuned at the factory. There is only one tuning adjustment…the oscillator warp (1). With fewer adjustments, pager reliability is improved, and field servicing is simplified.
	The front end of the unit is contained on a single hybrid circuit (2) covering the entire 851-866 MHz frequency range.	Increases the pager's reliability. Also, pager frequency changes are more easily accomplished since there are no band splits. A crystal change and one oscillator warp adjustment are all that's required. No new receiver board is necessary.
	Broadband stripline filter (3), laser trimmed for space-age accuracy	Improves reliability and eliminates the need for selectivity tuning adjustments.
	Solderless interconnections of radio components	Simplify factory alignment, insure reliable performance in the field, and improve serviceability.
Rugged Construction	Built with a durable, one-piece polycarbonate plastic housing, protective rubber gasket, nickel-chrome plated die cast metal top, speaker grill cloth and strong metal clip	Internal components protected from dust and contaminants, and damage due to impact. The solid construction and superior quality assure you of a pager you can depend on time after time. DIMENSION IV pagers are built to stay in service. Tested to meet or exceed EIA standards.
Pager Controls	Thumbwheel volume control and on-off switch	The thumbwheel provides user flexibility in adjusting the audio level, depending upon environmental conditions.
	Reset switch	Conveniently positioned for ease of operation.
Audio Output	85 dB SPL at 12 inches for both the alert tone and the voice message	Your important messages come through loud and clear.
Single Battery Operation	A single 1.4V mercury or 1.3V nickel-cadmium "N" cell battery	For maximum user flexibility, you have the choice of either a disposable or a rechargeable battery. Also, this single volt approach saves you money when battery replacement is necessary.
PERMACODE Active Filters	Solid-state active filters	These plug-in filters offer the utmost in reliability, and immunity to mechanical falsing due to vibration and shock. They can be changed in a matter of seconds, affording system flexibility in coding.

Features	Description	Benefits
Single Board Design	A single, fiberglass reinforced printed circuit board containing all of the pager's electronic circuitry slides into the pager housing, which is then sealed by a rubber gasket and a metal top.	Provides exceptional strength and protection of the circuitry while increasing ease of servicing.
Options		
Group Call	Page either an individual or a group in a matter of seconds. The group call alert tone is steady, in contrast to an interrupted alert tone for an individual call. The number and size of the groups depend on the code capacity of the system.	Paging a group saves valuable time over paging each member separately. By having differentiated alert tones, you know exactly how you are being paged.
Fixed Alert/Variable Audio	The alert tone is fixed at the maximum volume while the voice audio is varied by turning the thumbwheel volume control.	In high ambient noise environments, this alert tone setting insures you'll hear important messages while providing audio flexibility as you alternate between quiet and noisy environments.
Push-To-Listen	The standard mode of operation for DIMENSION IV pagers is automatic listen, push-to-reset. In this mode, the voice message automatically follows after the alert tone. With the push-to-listen option, the alert tone will sound, but the voice message will not follow unless the reset bar is depressed and held down to receive the message.	Affords greater privacy because the voice message follows only if the user desires.
Colored Housings	Available in shadow bronze, red or white housings.	The choice of colors serves a variety of needs, including color-keying your pager inventory or complimenting your business uniforms. Colored housings add a touch of distinction.
Extended Warranty	Both three-year and five-year extended warranties are available.	Potential savings in repair costs for an extended period of time.
Accessories		
Battery Chargers	Single unit chargers are available in 117V ac or 234V ac models. Each will charge one pager and one spare battery simultaneously. A multiple unit master charger with space for 5 pagers and 5 spare batteries and an auxiliary charger with space for 6 pagers and 6 spare batteries are also available. Both operate on 117V ac or 234V ac. By adding up to three auxiliary chargers to one master charger, you can charge a maximum of 23 pagers and 23 spare batteries simultaneously. LED indicators show positive contact on the pager and battery charge contacts. The chargers feature a protective interlock device to prevent accidental charging of mercury batteries.	Whatever your charging requirements, there's a DIMENSION IV battery charger to suit your needs. The 117V single unit chargers are UL approved in accordance with UL Standard #1270, "Standards for Safety-Radio Receivers, Audio Systems, and Accessories," which assures the user that the unit should not present an electrical shock or fire hazard under normal operating conditions. This UL approval is **not** the same as the UL intrinsically safe listing. The chargers are **not** designed for use in hazardous or potentially hazardous atmospheres.

DIMENSION IV FM Radio Pager

Performance Specifications

Model:	A05DVC Series
Frequency:	851-866 MHz
Weight: w/mercury battery	6.3 oz. (176g)
Dimensions:	3.5″ x 2.4″ x 0.8″ (8.9 x 6.1 x 2.1 mm) 6.7 cu. in. (109 cu. cm.)
Sensitivity	Field Strength
Paging (EIA 8 pos. avg.):	30 uV/M
20 dB Quieting:	90 uV/M
12 dB Sinad:	50 uV/M
Selectivity (EIA):	70 dB @ ± 25 KHz
Spurious & Image Rejection:	40 dB
Audio Output	
Alert Tone:	85 dB SPL @ 12″
Voice:	85 dB SPL @ 12″
Frequency Stability:	± .0005% (−10°C to +50°C)
Channel spacing:	25 KHz
Power Supply:	One 1.3V rechargable nickel-cadmium or one 1.4V mercury battery
Power Consumption:	5.5 mA (standby) 170.0 mA (at rated audio output)
Battery Life[1]: (in hours):	**Mercury** 150 **Nicad** 30

[1] Based on 15, ten-second calls in an 8-hour period.

Battery Chargers for DIMENSION IV FM Radio Pager

Single Unit Battery Chargers

Model:	NLN4508	NLN4509
Accommodates:	One DIMENSION IV tone-and-voice pager and one spare battery	One DIMENSION IV tone-and-voice pager and one spare battery
Input:	117V ac, 50-60 Hz	234V ac, 50-60 Hz
Output per Charging Position:	18 mA (nominal)	18 mA (nominal)
Recharge Time: To replace 30 hrs. of operation—	Approx. 12 hours	Approx. 12 hours
To replace 15 hrs. of operation—	Approx. 6 hours	Approx. 6 hours
Size:	4⅝″ x 3⅛″ x 2¾″ (117 mm x 79 mm x 70 mm)	4⅝″ x 3⅛″ x 2¾″ (117 mm x 79 mm x 70 mm)
Weight:	13 oz. (369g)	13 oz. (369g)

U.L. Approval: 117V single unit chargers are UL listed in accordance with Standard # 1270—"Standards for Safety-Radio Receivers. Audio Systems and Accessories."

Multiple Unit Battery Chargers

Model:	NLN4510 (Master)	NLN4511 (Auxiliary)
Accommodates:	Five DIMENSION IV tone-and-voice pagers and five spare batteries	Six DIMENSION IV tone and voice pagers and six spare batteries
Input:	117/234V ac, 50-60 Hz	117/234V ac, 50-60 Hz
Output per Charging Position:	18 mA (nominal)	18 mA (nominal)
Recharge Time: To replace 30 hrs. of operation—	Approx. 12 hours	Approx. 12 hours
To replace 15 hrs. of operation—	Approx. 6 hours	Approx. 6 hours
Size:	12″ x 6¾″ x 5″ (305 mm x 171 mm x 127 mm)	12″ x 6¾″ x 5″ (305 mm x 171 mm x 127 mm)
Weight:	6 lbs. (2.7 kg)	5 lbs. (2.3 kg)

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800 MHz SYSTEMS

INSTALLATION AND MAINTENANCE NOTES

BY:

MOTOROLA C & E, INC.
AREA F ENGINEERING
FTR

COMPANY CONFIDENTIAL

Possible Interference Sources

1. Television transmitters (ch. 67-69)
2. TV translators (share the 800 MHz band on a secondary basis)
3. 406-433 MHz harmonic radiation

Minimum Required Separation between UHF Television Transmitters and 800 MHz Repeaters

(for 0.5 microvolt effective sensitivity)

ch 69 (800-806 MHz)	14 miles
ch 68 (794-800 MHz)	7 miles
ch 67 (788-794)	3 miles

Service Considerations

1. Motorola service monitors require the HSO option. Not all frequency meters will meet stability requirements. (0.0001% stability requires 0.00005% or better frequency meter accuracy.) Note: HSO option for S1327 series service monitor provides ≠0.003 PPM stability.

2. The entire antenna assembly must be replaced when reinstalling a new 800 MHz radio in a vehicle that had a UHF system.

3. RG 58/U must not be used anywhere in an 800 MHz system. Not even for bench testing.

4. Tests indicate that properly installed trunk mount antennas are not significantly worse than roof top antennas. A breakage problem may result though when semi-flexible antenna cable is used between the trunk lid and the radio.

5. Only use prescribed coaxial connectors. Bakelite and plastic insulators are very lossy at these frequencies.

June 7, 1982

Memo To: Area F Service And
MSS Community

From: Western FTR District

Subject: Mobile Installations and R.F. Interference

As a result of several complaint inputs recently we have taken a closer look at mobile installations with regard to interference to vehicle systems.

Some of the problems observed have been lock-up of electronic brake balance systems, windshield wiper activation, electronic ignition misfiring, electronically-switched accessories such as interior lighting, turn signals, etc., switching on during transmissions.

Most R.F. interference is radiated from the antenna directly into the vehicles computer or engine electronics. High power mobiles and 800 MHz systems are more likely to cause these problems than lower frequency radios and low power installations.

Antenna placement and type can be critical. A magnet-mount test antenna is useful for verifying that a selected antenna location on the vehicle will be 'clean'. This requires that the mobile radio installation be completed before any antenna holes are drilled.

A gain antenna will often eliminate a moderate RF interference problem by directing the R.F. signal above the vehicle, thereby reducing the signal level entering the critical vehicle electronics.

The use of magnet-mount or clip-on antennas should be discouraged. These antennas do not have a good ground plane, and can therefore intensify a vehicle interference problem. If a magnet-mount or clip-on antenna must be used, then teflon cable will be required in place of the RG58/U that is usually supplied.

The rooftop is ideal for performance and minimizing vehicle systems interference. Rear deck or trunk mounted antennas can cause problems through the rear window, or by coupling RF into the rear window defroster which then couples into the vehicle electrical system.

The vehicle computer on most American and European vehicles is mounted behind the right kick panel.

Mercedes has a grounded computer box mounted directly to metal. Chevrolet has a metal box that is insulated by a pocket in the plastic kick panel. Delco cautions that this box is not to be grounded! Apparently a ground would only be a problem if one of the vehicles logic states were to short out. If grounded, that could result in a wiring harness fire!

Some vehicles have as many as three computer boxes. The other two are usually mounted in the area behind the glove compartment.

Aluminum foil wrapped around the leads to the computer or around the computer itself has been moderately successful. Be careful not to short out any active leads with the foil.

Poor engine performance while transmitting can often be traced to R.F. detection at the vehicles M.A.P. sensor (engine mixture, air, pollution control). On G.M. cars this device is usually mounted on the right fender well, behind the battery. On older G.M. cars (1980 and before) this may be a round-shaped Bendix device. If so, per Delco, the dealer should replace it with the later square Delco part which is much more R.F. immune.

Delco also recommends that all power feed wires from transmitters be run on the left side of the vehicle, and not in the close proximity of the M.A.P. sensor.

The MSS may try some simple fixes for these problems. Attaching a dummy load to the transmitter will help isolate the interference source. If the problem only occurs when on the antenna, then you can be sure it is direct radiation. If it still occurs on the dummy load, then the R.F. coupling is on the power leads.

Wrapping the computer and leads and verifying the source of the interference is pretty much all that can be done. If the problem cannot be further defined, then request sales to write a customer complaint, and an FTR will be made available to work with the car manufacturers area representative. Do not further modify any vehicle yourself. Your good intentions can result in legal trouble!

RG*mc

TRUNKING SYSTEMS

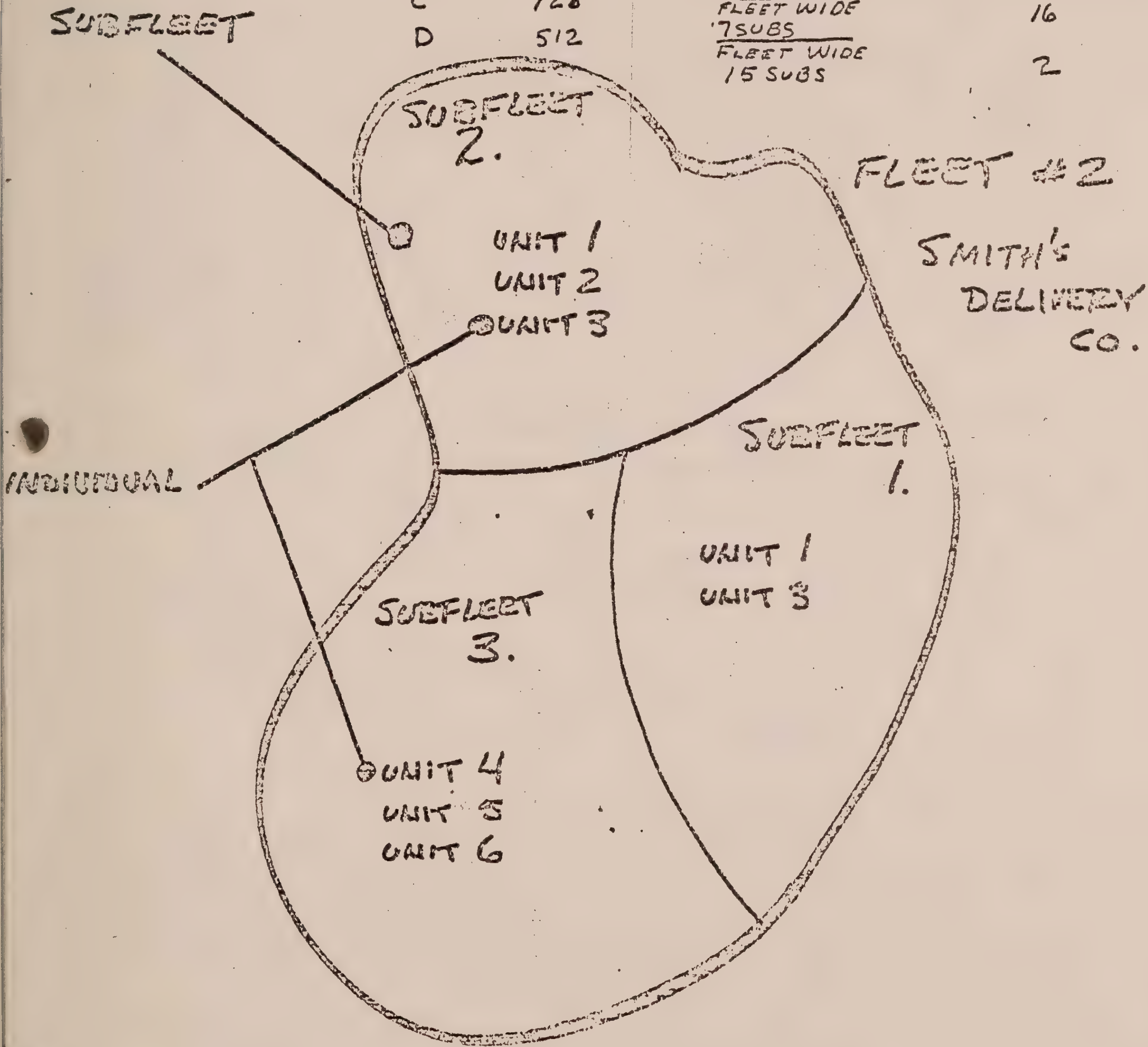
FEATURES OF BASIC TRUNKED SYSTEM

- FLEET CALL
- LESS WAITING TIME
- MORE MOBILES/CHANNEL
- NO CHANNEL MONITORING
- PRIVACY OF COMMUNICATIONS
- NO INTERFERENCE BETWEEN FLEETS
- MISDIRECTED MOBILE PROTECTION
- AUTOMATIC RETRY
- COMMON MOBILE UNITS THROUGHOUT SYSTEM
- ORDERLY LONG TERM GROWTH
- ALL CHANNELS BUSY QUEUING
- RECENT USER PRIORITY QUEUING
- BACKUP CONTROL CHANNELS
- TRANSMITTER FAILURE SHUTDOWN
- RECEIVER INTERFERENCE SHUTDOWN

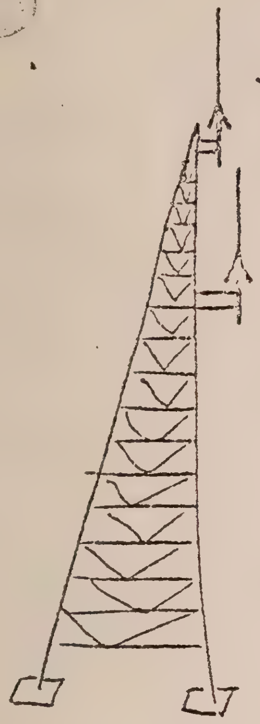
FLEET DIAGRAM

20ch

FLEET	MAX # IND	PARTITIONING	MAX # OF TYPE IN SYSTE
A	16	FLEET WIDE 3 SUBS	255
B	64	FLEET WIDE 7 SUBS	32
C	128	FLEET WIDE 7 SUBS	16
D	512	FLEET WIDE 15 SUBS	2



TRUNKED SYSTEM SIGNALING



OSW = Outbound Signalling Word

CONTROL CHANNEL
1) BACKGROUND DATA WORD – 3600 BAU
2) OSW – 23 MS – 3600 BAUD
    FLEET ID
    SUBFLEET ID
    INDIVIDUAL ID
    CHANNEL #
3) SYSTEM ID AND CONTROL CHANNEL #
    EVERY 3 SECONDS

VOICE CHANNEL
FLEET SUBFLEET → 1) HIGHSPEED HANDSHAKE – 3600 BAUD
FLEET SUBFLEET → 2) CONNECT WORD – 150 BPS – LSH
3) DISCONNECT WORD – 300 BPS
4) FAILSOFT WORD

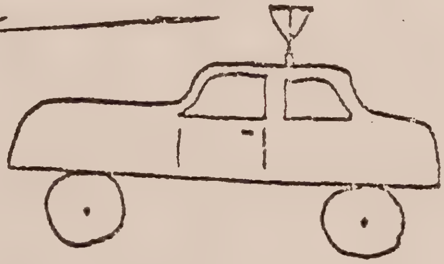
1) ISW – 3600 BAUD
    FLEET
    SUBFLEET
    INDIVIDUAL ID

CONTROL CHANNEL

VOICE CHANNEL

1) ACKNOWLEDGE 1800 HZ
2) CONNECT TONE 105 HZ
3) DISCONNECT TONE 163 HZ

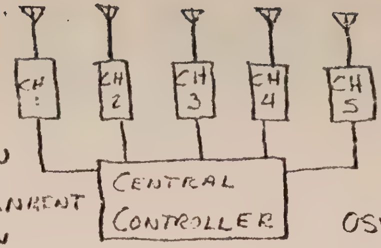
UNIVERSAL TO ALL UNITS



Sequence For Chan Assignment

Mobile End

Provides:
Sync For Mobile ISW
Channel Assignment Information



Base End

OSW Transmited Continually On Control Channel

Step 1 PTT Pressed, Mobile Sends ISW (78 Bit @ 3600 BPS) On Control Channel

Step 2 Channel Request Is Queued Controller Assigns Unit To A Voice Channel By Way Of OSW

Step 3 Receiving OSW On Control Channel Mobile Switches To Assigned Voice Channel

Step 4 With OSW Still Being Transmitted On Control Channel, Controller Also Transmits A High-Speed Handshake (HSH) On The Assigned Voice Channel. Sync With OSW On Control Ch. (21 Bit @ 3600 BPS)

Step 5 Mobile Recognizes HSH On Assigned Voice Ch. Mobile Keys Up And Transmits 80ms Of High-Speed Acknowledge Tone (1800 Hz)

Step 6 Controller Sees High-Speed Ack Tone. Stops Sending HSH And Replaces It With An Identical Version Sent At 150 BPS Know As Low Speed Handshake (LSH)

Step 7 Operator Can Now Talk Mobile Sends A Continuous nect Tone At Low Dev. (105,88 Hz)

SEQUENCE FOR CHANNEL ASSIGNMENT AND DISCONNECT

MOBILE END

BASE END

NOTE: OTHER MOBILES IN THE SAME FLEET OR SUBFLEET ARE SWITCHED TO ASSIGNED VOICE CH., LOOK FOR HSH AND DETECTION WILL UNMUTE RX. IF THEY MISSED HSH, WILL UNMUTE AFTER DETECTING AN ENTIRE LSH WORD.

STEP 8 PTT RELEASED MOBILE SENDS 200MSEC. OF DISCONNECT TONE (163.64HZ) AT LOW DEV.

STEP 9 CONTROLLER DETECTS DISCONNECT TONE AND STARTS MESSAGE TOT (2 SECONDS)

new version

STEP 10

MOBILE NOW IN RX MODE HEARS LSH

OTHER MOBILE OR MOBILES MAY RESPOND SENDING CONNECT TONE. MUST RESPOND BEFORE TOT TIMES OUT TO KEEP PRESENT ASSIGNED CHANNEL

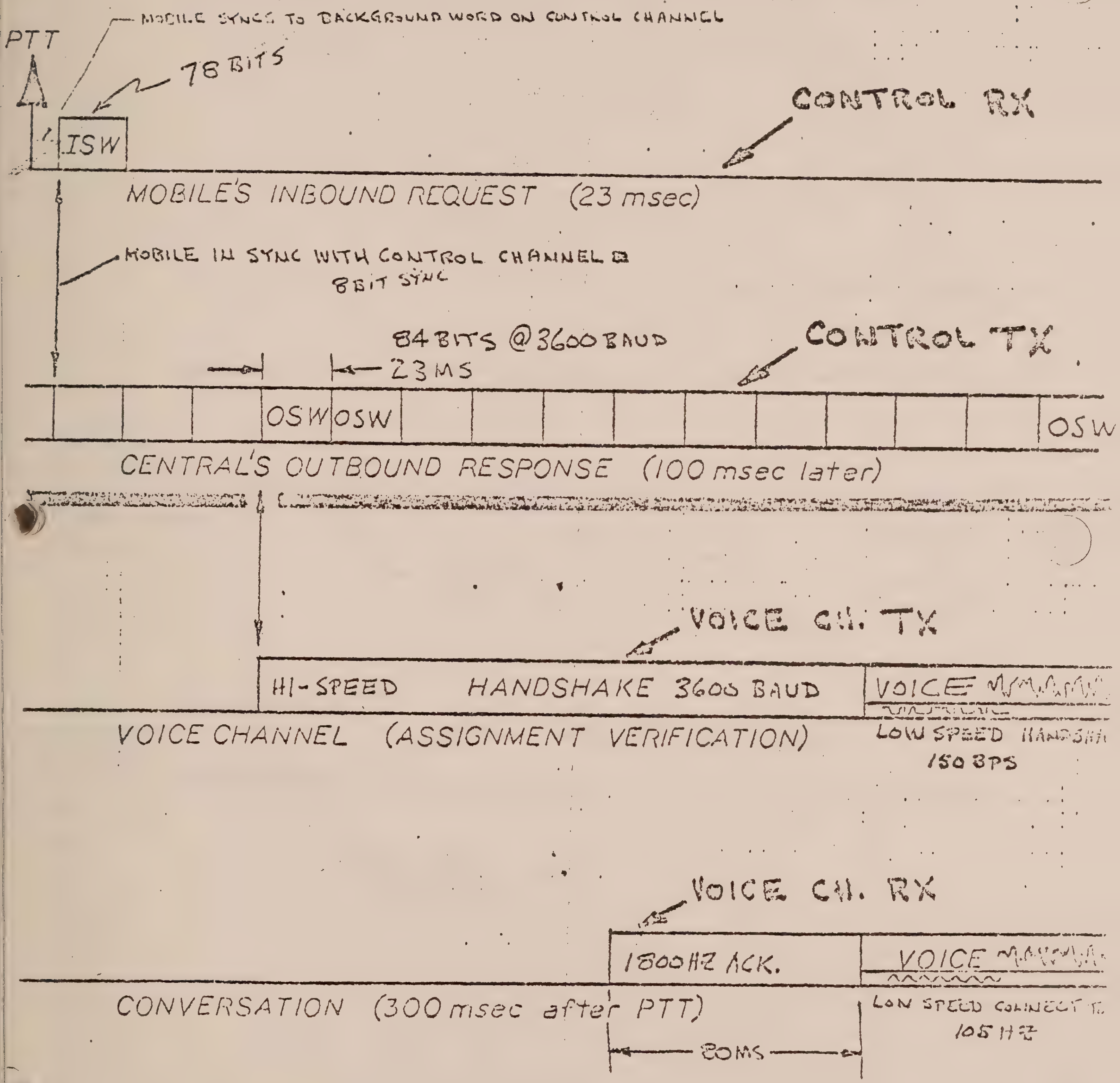
STEP 11 CONTROLLER SEES OTHER MOBILE CONNECT TONE AND RESETS MESSAGE TOT

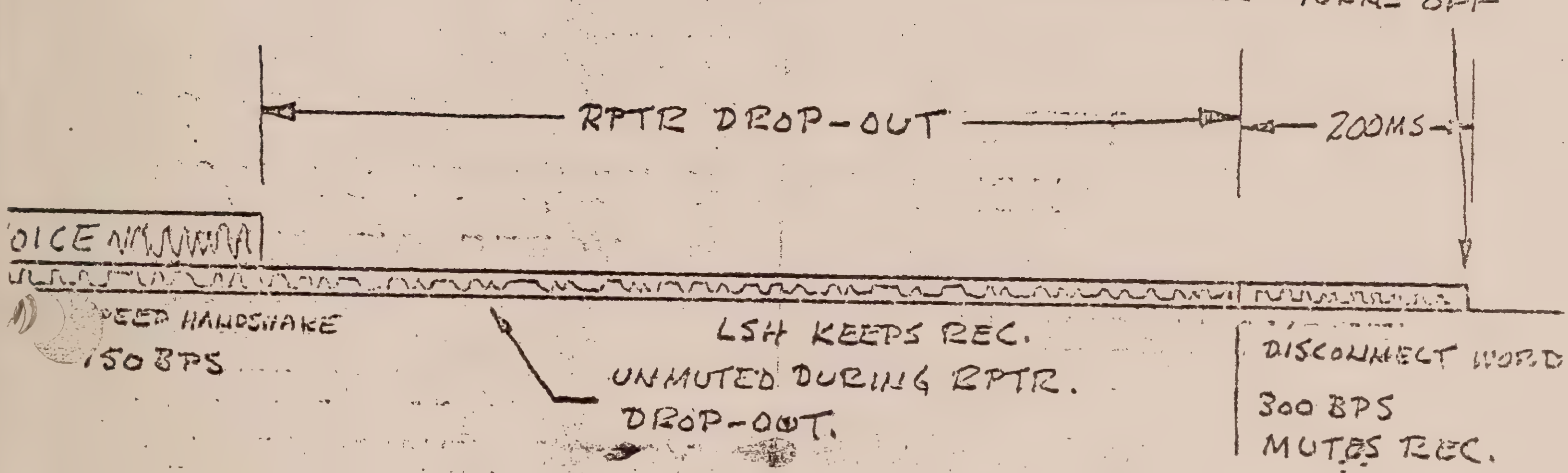
STEP 12 MESSAGE TOT TIMES OUT, CONTROLLER DISCONNE MOBILES BY PLACING A CONTINOUS LOW-SPEED DISCONNECT WORD ON VOICE CHANNEL
(REPETIVE SYNC PATTERNS AT 300BPS WITH LOW DEV.)

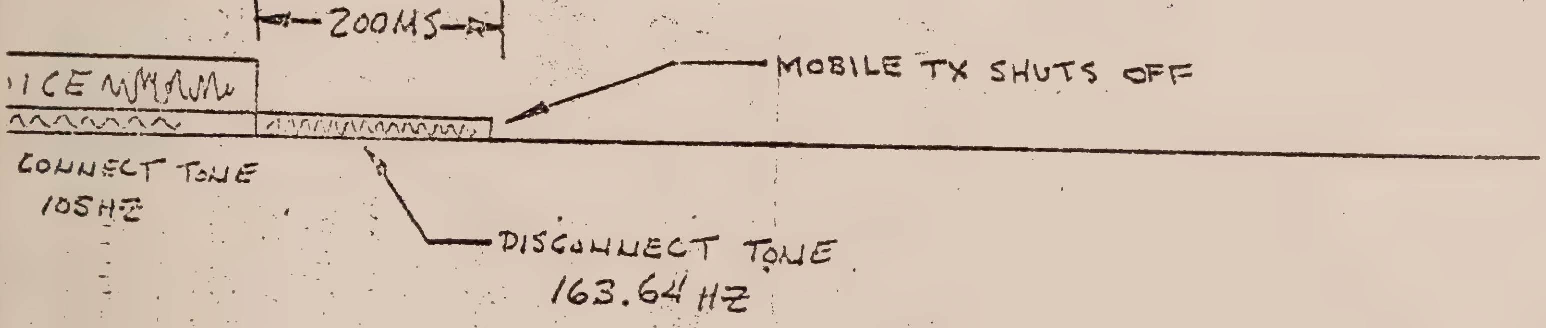
STEP 13

MOBILE RETURNS TO THE CONTROL CHANNEL WHEN DISCONNECT WORD IS DETECTED.

SYSTEM TIMING DIAGRAM




VOICE CHANNEL TURNS OFF
RPTR DROP-OUT
200MS
OICE
PEED HANDSHAKE
150 BPS
LSH KEEPS REC. UNMUTED DURING RPTR. DROP-OUT.
DISCONNECT WORD
300 BPS
MUTES REC.


200MS
ICE
MOBILE TX SHUTS OFF
CONNECT TONE
105HZ
DISCONNECT TONE
163.64 HZ

CODE PLUG

- TTL
- FUSIBLE LINK
- NOT REPROGRAMMABLE
- 16 PIN D.I.P. PACKAGE
- PLUG IN
- LOCATED IN MOBILE CONTROL HEAD

- PART NUMBER, 51-83482K01

TRN 8711A

CODE PLUS CONTENTS

SYSTEM I.D.

FLEET I.D.

INDIVIDUAL I.D.

SUBFLEET TABLE

CHANNEL TABLE

FAIL SOFT, CHANNEL

TALK PERMIT TONE FLAG

TIME OUT TIMER

INTERPRETATION OF THE CAPS, CODES AND NOTES

All STIC-1's for Trunked Mobiles and Consolettes must contain one line of CAP and CODES per unit as well as certain notes per main item.

CAPS

I. Single sub-fleet mobiles (T45RTA5B00A_), Accessory Groups (RT1501_), (RT1502_), Control Stations (L35RTB1160_MSP801):

CAP will be 2 digits, from 00 to 15. This indicates the sub-fleet assignment. A "00" indicates fleet-wide call programming.

II. Five sub-fleet select mobiles or accessory groups (options W346 or W347) and 6 position fleet/sub-fleet select control stations (option L335):

CAP will be a string of number pairs or the character pair OS. The numbers may be 00 through 15. No other entries are allowable. There will be 5 pairs in the string, a total of 10 characters.

These pairs correspond to the 5 subfleets selected when buttons A through E are depressed. The pair OS indicates that the respective button is fitted with a mechanical button stop.

Example:

CAP
010206000S

Means: Button A selects sub-fleet 1
Button B selects sub-fleet 2
Button C selects sub-fleet 6
Button D selects fleet-wide call
Button E is fitted with a stop

III. Sixteen position fleet/sub-fleet select control stations (option L336).

BLANK is entered in the cap field because the numbering on this switch corresponds exactly with the sub-fleet number.

Instead a note is added telling how many sub-fleets are available in this fleet (either 3, 7 or 15).

Example: 7 SUB FLEETS

CODES

All code formats are identical regardless of model and options.

They consist of 4 groups of 3 characters each. The groups are separated with commas.

$$\underbrace{X\,\underbrace{X\,X}}\,,\,\underbrace{X\,X\,X}\,,\,\underbrace{X\,X\,X}\,,\,X\,X\,X$$

These 6 digits together are the code plug number.

PREFIX: Must be a number from 0 to 7.

FLEET ID: Right justified hexadecimal. Must be numbers from 0 to 9 or the characters A, B, C, D, E or F.

INDIVIDUAL ID: Right justified hexadecimal. Must be numbers from 0 to 9 or the characters A, B, C, D, E or F.

TIMEOUT TIMER: The value of the timeout timer in seconds. May be either 000, 015, 030 or 060. "000" means no timeout.

FAILSOFT CHANNEL: Must be a number from 0 to 5. "0" means that failsoft operation is denied.

OPERATOR ALERT: Must be either "S" or "P". S means silent entry, P means talk permit entry.

TRUNKING TYPE: 'M' means message trunking.

Example: 30A,020,030,MS4

NOTES

Each main item must contain a note giving the system number.

Example: SYSTEM NO. 3425

A sequence number from 00 to 99.

Background word identifier: Right justified hexadecimal. First digit may be 0, 1 or 2. Second digit may be a number from 0 to 9 or the characters A, B, C, D, E or F.

800 MHz TRUNKING INFORMATION

CUST NAME
OWNER'S NAME
ADDRESS
CITY ST ZIP
FLEET NO.
TEL NO. AREA CODE
SYSTEM CENTRAL CONTROLLER - NAME
SYSTEM NUMBER
SPECIFY ORDER NUMBER
PAGE NO. OF PAGES

ADD NEW FLEET TO EXISTING SYSTEM

total number of mobiles and control stations expected in next five year period ☐☐☐

Note: Consult sales mgmt. for approval of above number. Subfleet capacity is determined by this number.

ADD UNITS TO EXISTING FLEET

Complete the following coding matrix identifying:

(1) Main line items requiring coding, quantities, and respective options.
(2) Vehicle identifier (max. 16 characters). If no name is requested, program will assign in sequence numerically.
(3) Time-Out-Timer Length — (00, 15, 30, 60 sec.)
(4) Entry Type — Talk Permit (P) or Silent Entry (S)
(5) Failsoft — Enabled (Enab) or Disabled (Disa)
(6) Subfleet Assignments:
Any number from 1 thru 15. Numbers can be used only up to the number of subfleets allowable for a particular fleet type. For mobiles with standard control head, list a single subfleet. (Put this selection in position A under subfleet position assignment.) For mobiles with W346 or W347 options, list subfleet selections for positions A, B, C, D, E. An "S" may be entered to indicate a button stop which will be placed behind the respective button rendering it inoperative. "ALL" may be entered to indicate fleet call.

Note: Allow one line for each individual unit.

							Subfleet Position Assignment				
QUANTITY	MODEL NO.	OPTION	VEHICLE IDENTIFIER	TOT	ENTRY TYPE	FAIL SOFT	A	B	C	D	E
1	T45RTA5B00-K	W347		30	S	ENAB	1	2	3	S	S
									X		
3	T45RTA5B00-K	W345	PETE	30	S	ENAB	1				
			JOE				2				
			VEHICLE #3				3				
1	L35RTB1160AM		BASE	30	P	ENAB	S	S	3	2	1 AL

TIME ELEMENT FOR MEETING LOADING REQUIREMENTS

In the case of conventional 800 MHz systems, a minimum of 70 percent of the mobile units specified in the application must be placed in operation not later than 8 months after the date of grant of the license.

There are two options available to a licensee of a trunked system—see Table 8. The first option, option A, *must* be adhered to when requesting the minimum *5* channel trunked system license. The second option, option B, is available to licensees of trunked systems *greater* than 5 channels. However, a licensee of more than 5 channels may elect to load under option A, if he so desires. The method of loading chosen must be specified in the license application.

When licensees do not load the channel or channels assigned in accordance with specified loading criteria such channels will be available for assignment to other applicants.

An applicant showing that a channel will be loaded to 70 percent of its assigned capacity within the time frame specified will be given exclusive use of his channel(s) over a given area (see Table 9).

REQUIREMENT FOR ADDING CHANNELS

Any licensee, at any time his authorized conventional or trunked system is occupied to 90 percent of its specified capacity, may apply for additional channel pairs. Assignments will be made based, first, upon availability of frequencies for use by the licensee, and, second, based upon the showing made by the licensee of his requirements for additional channel pairs.

MAXIMUM NUMBER OF CHANNELS ASSIGNABLE

The maximum number of frequency pairs that may be assigned to any one licensee for the operation of a conventional radio system shall be five, except for licensees in the Taxicab Radio service. Trunked systems, on the other hand are authorized from a minimum of 5 channels to a maximum of 20 channels.

TABLE 8
TIME ELEMENT FOR LOADING TRUNKED SYSTEMS

	Time From Grant of License	Requirement
Option A	6 Months	Begin System Construction.
	1 Year	Complete System Construction.
	5 Years	Load System to 70 Percent.
Option B (More Than 5 Channels)	6 Months	Begin Construction of First Five Channels.
	1 Year	Complete Construction of First Five Channels.
	2 Years	Load First Five Channels to 70 Percent.
	5 Years	Complete Total System Construction.
	5 Years	Load Total System to 70 Percent.

TABLE 9
MINIMUM CO-CHANNEL PROTECTION DISTANCES IN MILES BETWEEN CENTERS OF SERVICE AREA

	Trunked	Urban-Conventional	Suburban Conventional	Wide-Area (L.A.)*
Trunked	70	▨	▨	105
Urban-Conventional	▨	100	110	120
Suburban-Conventional	▨	110	110	130
Wide-Area (L.A.)*	105	120	130	▨

*Santiago Peak, Sierra Peak, Mount Lukens, Mount Wilson.

RESTRICTIONS ON ALLOWABLE OPERATIONS

Where a channel or channels are timeshared among two or more users, secondary fixed operations, mobile repeaters, and mobile units on base station frequencies will not be permitted. Rule Section 89.655 does make provision for all three of these modes of operation, provided they are consistent with existing rules governing the service in which the licensee is authorized to operate, and provided that the applicable loading standards are met and the channel assigned has been made available for the *exclusive use* of that licensee.

A system licensed for use by a person or entity eligible under either Parts 89, 91, or 93 may be employed for any purpose or operated in any manner, including the use of F2, F4, and F9 emissions, which is consistent with the regulations governing the service in which the user is eligible: *Provided*, the loading standard which applies to the system is met and the channel or channels are assigned to that person or entity for its *exclusive* use.

Mobile relay or repeater operations will not be assigned on channels to be used in two-frequency simplex mode, and vice versa.

Systems employing full duplex mode of operation will not be licensed on frequencies assigned for mobile relay or two-frequency simplex systems.

Applicants in one service group will not normally be required to share frequencies with applicants in other service groups.

MOTOROLA

MOTRAR 5 Trunked Mobile/Control Station Radio

TX: 816-821 MHz
RX: 861-866 MHz
10 Watts
For use in five channel trunked systems only

MOTRAR 5 Trunked Mobile/Control Station Radio

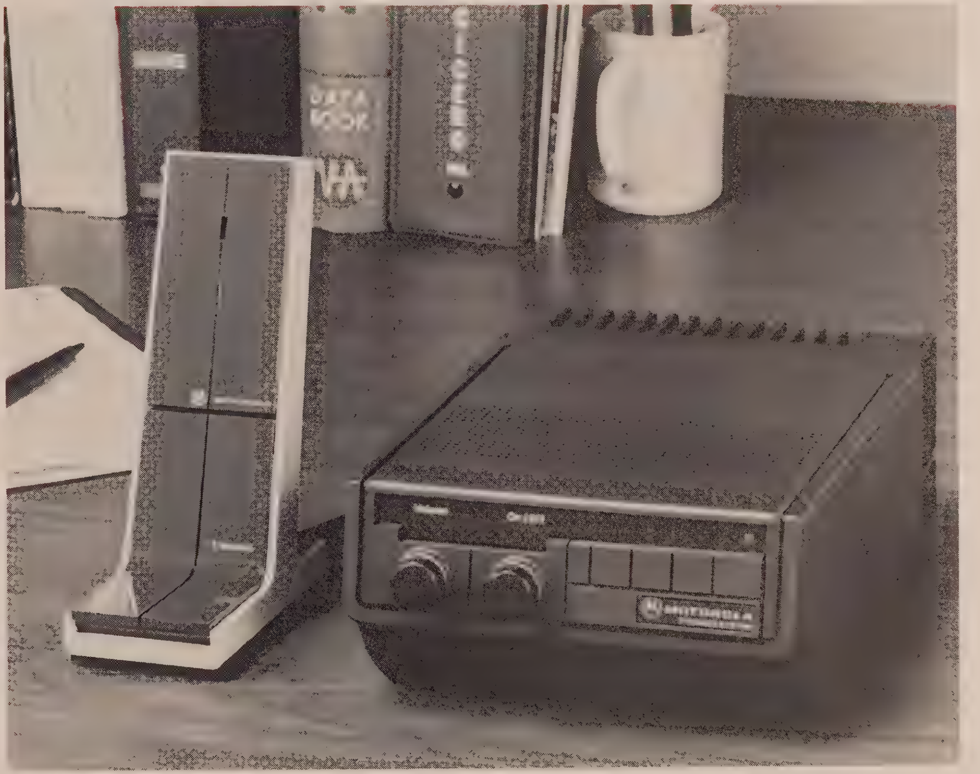
STANDARD

Feature	Description	Benefits
Trunked System Operation	The Motrar 5 radio contains all the logic circuitry required to integrate this trunked mobile into a fully automatic trunked 5 channel sharing system.	Motorola's Trunked Systems result in simplified mobile operation by the elimination of frequency selection, squelch controls, and monitoring requirements. They provide privacy from other system users, and up to 5 channel operation.
Five Channel Operation	The Motrar 5 radio comes fully equipped for up to 5 channel operation.	Five channels expand communications capabilities by providing substantially more channels to handle call requests.
Synthesized Operation	Specific RF frequencies are created electronically rather than by individual crystals or channel elements.	No channel elements are required. Synthesizer operation eliminates the need to return a radio for servicing to implement additional channels when the system grows in its number of frequencies. The radio will accommodate a total of 5 channels.
All Solid State	Transmitter, receiver, synthesizer and microprocessor control system are 100% solid state.	The Motrar 5 radio provides full rated transmit and receive power at turn-on. Cooler operation allows longer component life, reducing maintenance in all systems.
Code Plug Flexibility	The Trunked fleet and subfleet assignments are contained in a code plug located in the radio.	This make it possible to reassign a mobile for operation in a different fleet or subfleet by simple replacement of the code plug. No additional tuning or adjustment is required.
Mobile to Base Flexibility	In addition to mobile operation, Motrar 5 can be used as a base/control station. An optional power supply is required for this type of operation.	Mobile to base operation allows you to substitute Motrar 5 for other control stations. With Motrar 5, you need never be off the air for more than a few minutes.
Dash Mount Installation	Motrar 5 is a dash mount radio which can also be mounted overhead.	Dash mounting the entire unit enhances easy installation in almost any size vehicle.
Contemporary Design	The radio's housing is made of strong, molded ABS with safety rounded edges.	Motrar 5 has been designed to withstand years of rugged use while maintaining its good looks. The lightweight, durable housing means low maintenance.
Time-Out Timer	Automatically shuts off the transmitter after a predetermined amount of time.	Prevents lock-up of a repeater, or tie-up of a channel by prolonged keying of the transmitter after the transmission has exceeded a preset time.

Feature	Description	Benefits
Simplified Maintenance	The Motrar 5 radio's servicing is accomplished with a built in microprocessor program and a Micor test set. Access to the radio is easy.	Standard Motorola test equipment is compatible with the Motrar 5 radio. Easy access and fixed tuned operation simplify preventive maintenance.
Simple Operation	The standard Motrar 5 is equipped with on/off control, volume control and transmit light.	Easy, hands on operation allows the operator to simply pick up the microphone and transmit.

OPTIONS

External Speaker	External 3 watt speaker is available in matching Shadow Plum color.	Provides ability to add louder audio capability in high noise level areas by positioning the speaker closer to the listener.



MOTRAR 5 Trunked Mobile/Control Station Radio

Performance Specifications

General Specifications

No. of Frequencies:	Five (not expandable)
Primary Power:	12V dc negative ground.
Dimensions:	3.4″ H x 6.7″ W x 10.8″ L (88.4 mm x 170.2 mm x 273.1 mm)
Weight:	Approx. 7.6 lbs. (3.5 kg) Shpg. Wt: approx 14.5 lbs. (6.6 kg)
Metering:	A single-scale 0 to 50 microampere meter or Motorola Portable Test Set can be used to measure all circuits essential to adjustment and checking.
FCC Transceiver Designation:	10W: ABZ89FT5605

Freq. (MHz)	Model Number	Radio Type	EIA Intermittent Minimum Rf Power Output	Operation	Max. Batt. Drain		
					Stdby. @ 13.8V	RCVR. @ 13.8V	Transmit @ 13.8V
816-821TX/ 861-866RX	D25WLA5B00AK	Mobile	10W	12V dc neg. grd.	.9	1.4	6.5A
	L35WLB51B0AM	Control Station					

Transmitter

Output Impedance:	50 Ohms
Spurious & Harmonics:	More than 56 dB below carrier (per EIA Spec RS152B)
Frequency Stability:	±.00025% of assigned center frequency from −30°C to +60°C ambient (+25°C ref.)
Modulation:	15F2 and 16F3: ±5 kHz for 100% @ 1000 Hz
Audio Sensitivity:	0.160V ±3 dB for 60% max. deviation @ 1000 Hz
Audio Response:	+1, −3 dB of a 6 dB per octave pre-emphasis characteristic from 300 to 3000 Hz
Audio Distortion:	Less than 3% @ 1000 Hz. 60% max. deviation
Maximum Frequency Separation:	5 MHz

Receiver

Channel Spacing:	25 kHz
Sensitivity— **20 dB Quieting:** **EIA SINAD:**	 .45 µV .35 µV
Selectivity: (EIA SINAD)	−70 dB @ ±25 kHz
Intermodulation: (EIA SINAD)	−70 dB
Spurious and Image Rejection:	−70 dB
EIA Modulation Acceptance:	±7.0 kHz minimum
Input Impedance:	50 Ohms
Audio Output:	3 watts at less than 5% distortion
Maximum Frequency Separation:	5 MHz
Frequency Stability:	.00025% of assigned center frequency from −30°C to +60°C ambient, (+25°C ref.)

Optional Speaker Accessory

Dimensions:	5″ x 5″ x 2½″ excluding mounting bracket (127 mm x 127 mm x 63 mm)
Weight:	1½ lbs. (680g)

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Communications and Electronics Inc.

A subsidiary of Motorola, Inc.
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Telephone (312) 397-1000

Specifications subject to change without notice.

MOTOROLA

MOTRAR 20 Trunked Mobile/Control Station

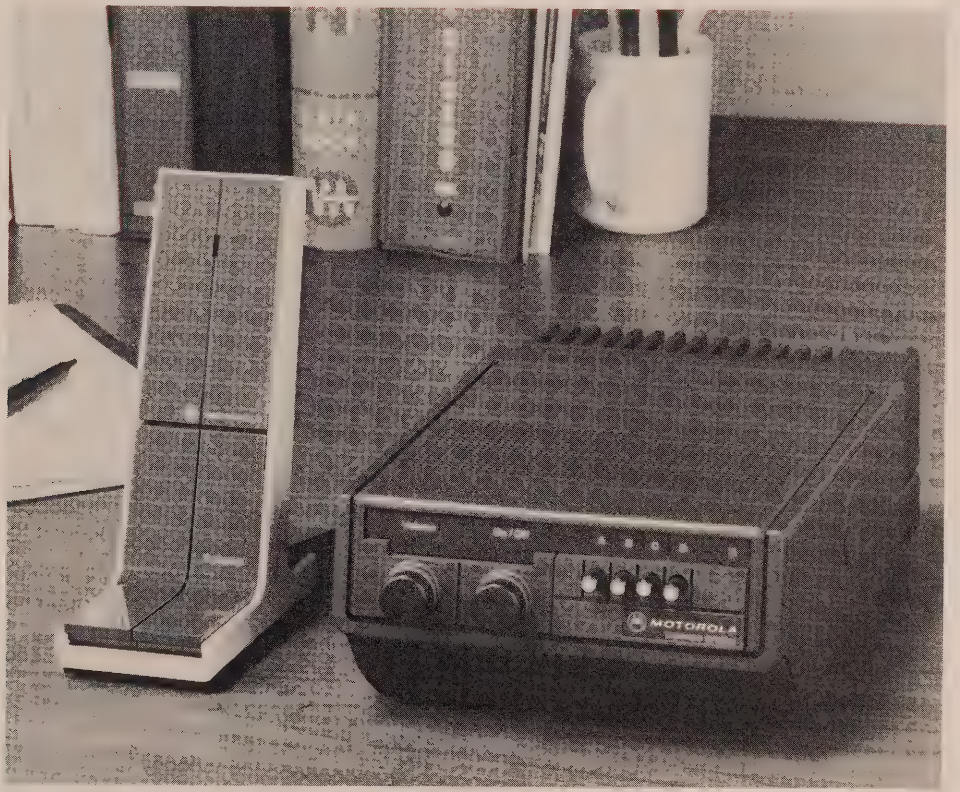
TX: 816-821 MHz
RX: 861-866 MHz
10 Watts

MOTRAR 20 Trunked Mobile/Control Station Radio

STANDARD

Feature	Description	Benefits
Trunked System Operation	The Motrar 20 radio contains all the logic circuitry required to integrate this trunked mobile into a fully automatic trunked channel sharing system.	Motorola's Trunked Systems result in simplified mobile operation by the elimination of frequency selection, squelch controls, and monitoring requirements. They provide privacy from other system users, and up to 20 channel operation.
20 Channel Operation	The Motrar 20 radio comes fully equipped for up to 20 channel operation.	20 channels expand communication capabilities by providing substantially more channels to handle call requests.
Synthesized Operation	Specific RF frequencies are created electronically rather than by individual crystals or channel elements.	No channel elements are required. Synthesizer operation eliminates the need to return a radio for servicing to implement additional channels when the system grows in its number of frequencies. The radio will respond automatically to system frequency growth.
All Solid State	Transmitter, receiver, synthesizer and microprocessor control system are 100% solid state.	The Motrar 20 radio provides full rated transmit and receive power at turn-on. Cooler operation allows longer component life, reducing maintenance in all systems.
Code Plug Flexibility	The Trunked fleet and subfleet assignments are contained in a code plug located in the radio.	This make it possible to reassign a mobile for operation in a different fleet or subfleet by simple replacement of the code plug. No additional tuning or adjustment is required.
Mobile to Base Flexibility	In addition to mobile operation, Motrar 20 can be used as a base/control station. An optional power supply is required for this type of operation.	Mobile to base operation allows you to substitute Motrar 20 for other control stations. With Motrar 20, you need never be off the air for more than a few minutes.
Dash Mount Installation	Motrar 20 is a dash mount radio which can also be mounted overhead.	Dash mounting the entire unit enhances easy installation in almost any size vehicle.
Contemporary Design	The radio's housing is made of strong, molded ABS with safety rounded edges.	Motrar 20 has been designed to withstand years of rugged use while maintaining its good looks. The lightweight, durable housing means low maintenance.
Time-Out Timer	Automatically shuts off the transmitter after a predetermined amount of time.	Prevents lock-up of a repeater, or tie-up of a channel by prolonged keying of the transmitter after the transmission has exceeded a preset time.
Simplified Maintenance	The Motrar 20 radio's servicing is accomplished with a built in microprocessor program and a Micor test set. Access to the radio is easy.	Standard Motorola test equipment is compatible with the Motrar 20 radio. Easy access and fixed tuned operation simplify preventive maintenance.

Feature	Description	Benefits
Simple Operation	The standard Motrar 20 radio is equipped with on/off control, volume control and transmit light. Optional multiple subfleet selection is also available.	Easy, hands on operation allows the operator to simply pick up the microphone and transmit.
Fleet Flexibility	The Motrar 20 mobile radio is fully compatible in fleets presently using any Motorola trunked radios.	Provides 100% system compatibility, allowing you to choose whichever radio best suits your communications needs.
Options		
Subfleet Select	Provides 4 push buttons mounted on the radio which can be programmed for either one fleet call and 3 subfleet positions, or 4 subfleet with no fleet call.	Allows user to segment his operation for selective communications with distinct subgroups within his fleet. This subdivision of a fleet permits privacy to an individual subfleet level.
External Speaker	An external 3 watt speaker is available in matching Shadow Plum color.	Provides ability to add louder audio capability in high noise level areas by positioning the speaker closer to the listener.



MOTRAR 20 Trunked Mobile/Control Station Radio

Performance Specifications

General Specifications

No. of Frequencies:	Twenty
Primary Power:*	12V dc negative ground.
Dimensions:	3.4″ H x 6.7″ W x 10.8″ L (88.4 mm x 170.2 mm x 273.1 mm)
Weight:	Approx. 7.6 lb. (3.5 kg) Shipping Wt: 14.5 lb. (6.6 kg)
Metering:	A single-scale 0 to 50 microampere meter or Motorola Portable Test Set can be used to measure all circuits essential to adjustment and checking.
FCC Transceiver Designation:	ABZ89FT5605

Freq. (MHz)	Model Number	Radio Type	EIA Intermittent Minimum Rf Power Output	Operation	Max. Batt. Drain		
					Stdby. @ 13.8V	RCVR. @ 13.8V	Transmit @ 13.8V
816-821TX/ 861-866RX	D25WLA5G00AK	Mobile	10W	12V dc neg. grd.	.9	1.4	6.5A
	L35WLB5170AM	Control Station					

Transmitter

Output Impedance:	50 Ohms
Spurious & Harmonics:	More than 56 dB below carrier (per EIA Spec RS152B)
Frequency Stability:	±.00025% of assigned center frequency from −30°C to +60°C ambient (+25°C ref.)
Modulation:	15F2 and 16F3: ±5 kHz for 100% @ 1000 Hz
Audio Sensitivity:	0.160V ±3 dB for 60% max. deviation @ 1000 Hz
Audio Response:	+1, −3 dB of a 6 dB per octave pre-emphasis characteristic from 300 to 3000 Hz
Audio Distortion:	Less than 3% @ 1000 Hz. 60% max. deviation
Maximum Frequency Separation:	5 MHz

Receiver

Channel Spacing:	25 kHz
Sensitivity— **20 dB Quieting:** **EIA SINAD:**	 .45 μV .35 μV
Selectivity: (EIA SINAD)	−70 dB @ ±25 kHz
Intermodulation: (EIA SINAD)	−70 dB
Spurious and Image Rejection:	−70 dB
EIA Modulation Acceptance:	±7.0 kHz minimum
Input Impedance:	50 Ohms
Audio Output:	3 watts at less than 5% distortion
Maximum Frequency Separation:	5 MHz
Frequency Stability:	.00025% of assigned center frequency from −30°C to +60°C ambient, (+25°C ref.)

Optional Speaker Accessory

Dimensions:	5″ x 5″ x 2½″ excluding mounting bracket (127 mm x 127 mm x 63 mm)
Weight:	1½ lbs. (680g)

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Eq. Cat.	Sec.	Item
R3	8.6	06

MOTOROLA

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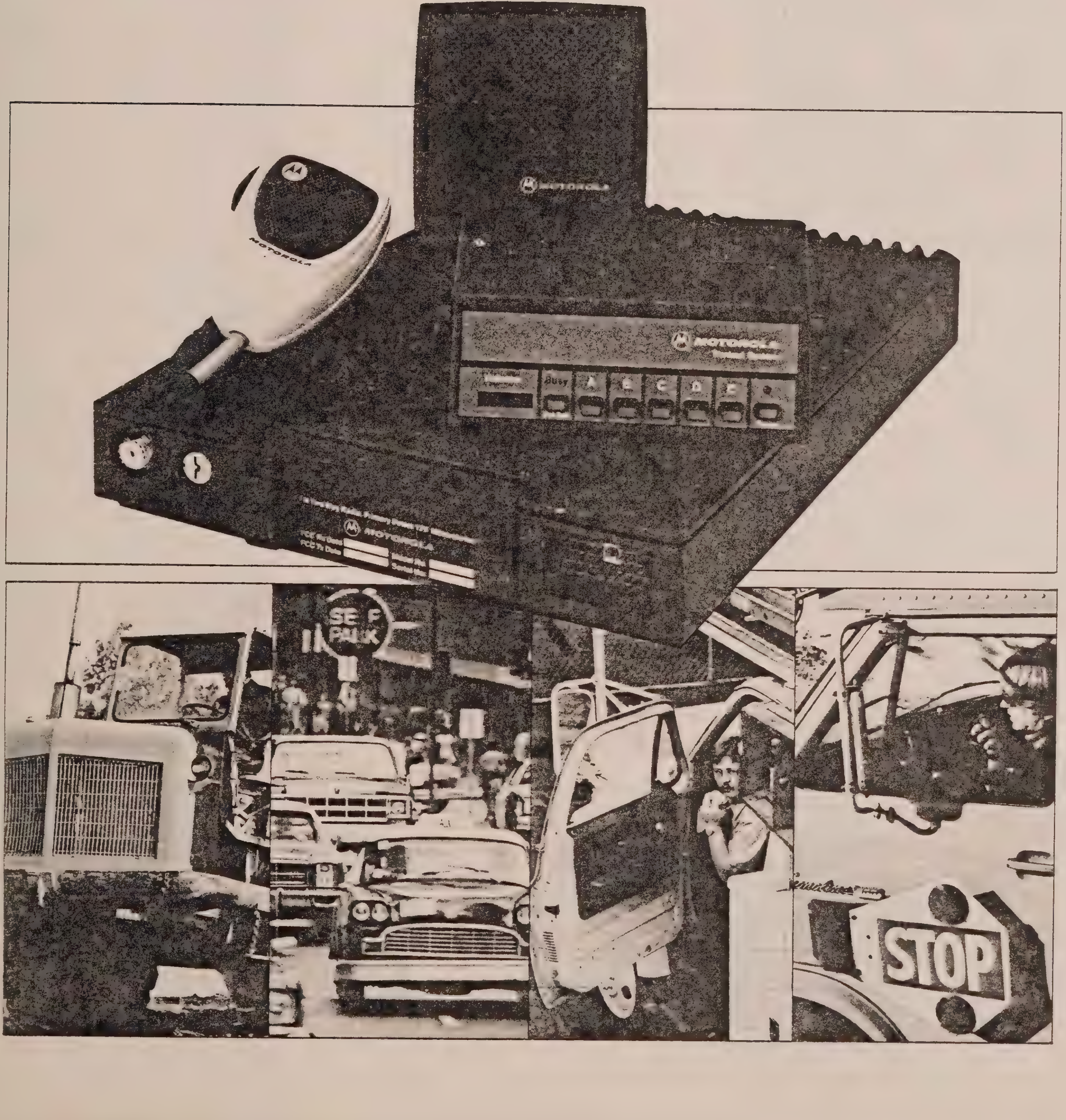
Trunked SYNTOR X FM Two-Way Radio

806-870 MHz
35 Watts



Trunked SYNTOR X FM Two-Way Radio

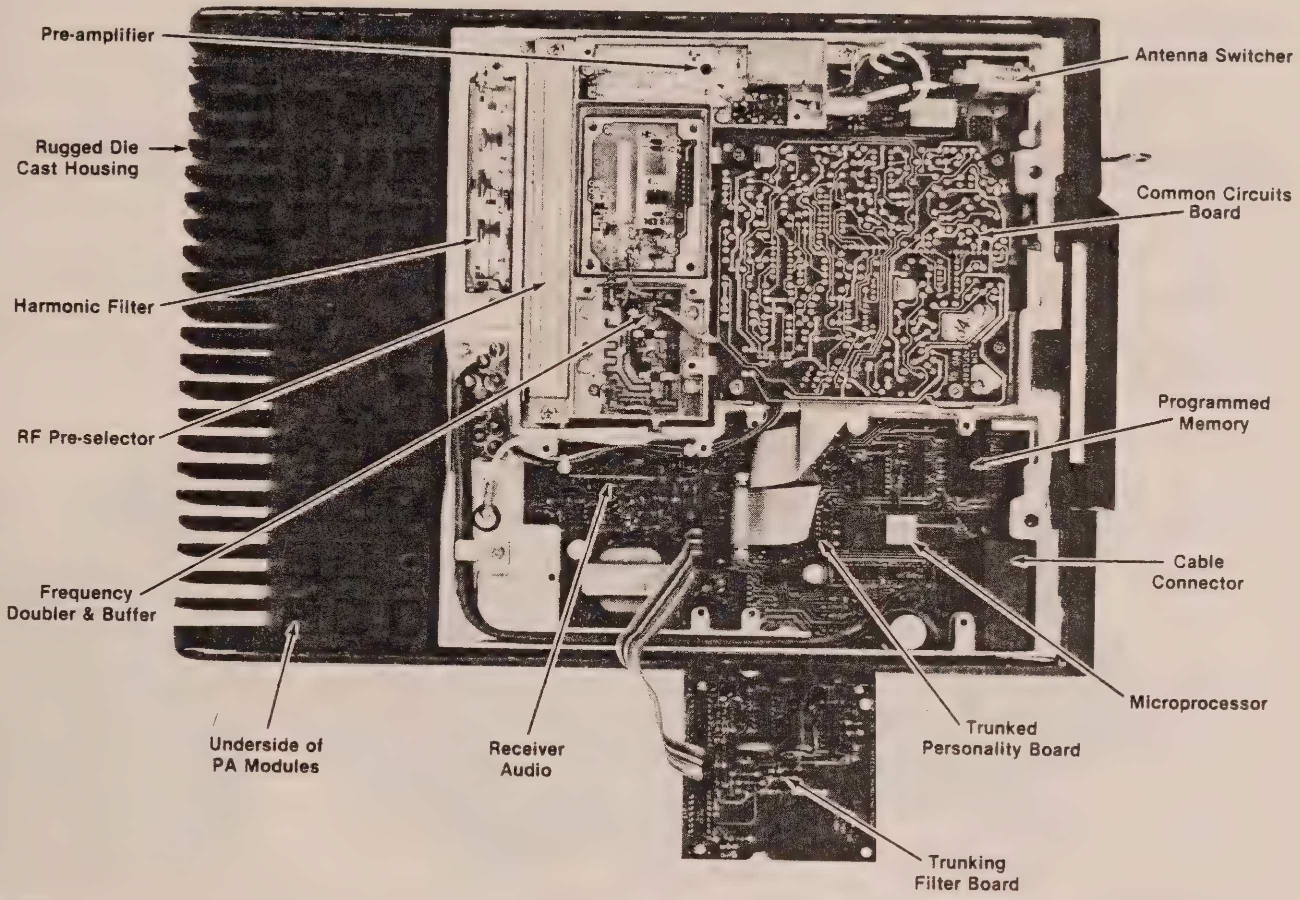
Feature	Description	Benefits
Trunked System Operation	The Trunked Syntor X radio contains all the logic circuitry required to integrate this high performance mobile into a fully automatic trunked channel sharing system.	Motorola's Trunked Systems result in simplified mobile operation by the elimination of frequency selection, squelch controls, and monitoring requirements. They provide privacy from other system users, and up to 20 channel operation.
20 Channel Operation	The Trunked Syntor X radio comes fully equipped for up to 20 channel operation.	20 channels expand communication capabilities by providing substantially more channels to handle call requests.
Fast-Lok Synthesizer	Specific RF frequencies are created electronically rather than by individual crystals or channel elements. The synthesizer spans the entire 800 MHz spectrum.	No channel elements are required. Synthesizer operation eliminates the need to return a radio for servicing to implement additional channels when the system grows in its number of frequencies. The radio will respond automatically to system frequency growth.
Transmitter Performance	The Trunked Syntor X radio transmitter features less than 2% audio distortion and spurs and harmonics at −85 dB.	Transmission is sharp and clear with a minimum of transmitter generated interference.
Receiver Performance	The Trunked Syntor X radio features −80 dB intermodulation protection, −80 dB selectivity at the first adjacent channel and a built-in preamp providing .25 μv (EIA SINAD).	Provides a clear signal in high RF density areas. Adjacent channel interference is minimized. Receives even extremely weak transmissions for improved distance coverage.
Audio	The Trunked Syntor X radio offers 15 watts of audio at less than 3% distortion.	Messages are loud and clear in high ambient noise areas.
Temperature	The Trunked Syntor X radio's operating temperature is −40°C to +70°C.	Performs to specifications over severe temperature extremes.
All Solid State	Transmitter, receiver, synthesizer and microprocessor control system are 100% solid state.	The Syntor X radio provides full rated transmit and receive power at turn-on. Cooler operation allows longer component life, reducing maintenance in all systems.

Feature	Description	Benefits
Environmentally Protected	The Trunked Syntor X radio unit meets MIL Spec 810C for shock, vibration, rain, salt and dust atmospheres. The Syntor X radio features a heavy duty one-piece cast all aluminum housing and cover, and solid steel mounting tray.	The radio unit can be used in areas exposed to adverse weather conditions without requiring weatherproof boxes or covers. Even out of its mounting tray, the Trunked Syntor X radio is weatherproof and exceeds EIA specifications used as an industry standard today.
Meets MIL Spec 810C	**MIL 810C (MARCH, 1975)** **Rain** (Method 506.1, Procedure I, rain chamber with wind source). Simulates 2-5 inches per hour of rain with a horizontal wind velocity of 40 mph for a total test time of two hours. **Dust** (Method 510.1, Procedure I, dust/fine sand). Checks for ability of equipment to withstand effects of wind-driven dust. The dust, a fine grained silica flour, is wind-driven at varying velocities, temperatures and relative humidities, for a total test time of 28 hours. **Salt Atmosphere** (Method 509.1, Procedure I, salt fog test). Determines durability of coatings and finishes exposed to corrosive salt atmospheres.	Test consists of exposure of the equipment to a salt fog atmosphere under controlled temperature and humidity conditions for a period of 48 hours. **Shock** (Method 516.2, Procedure III, Crash Safety-half sine wave curve). Assures, if mounted correctly, that tested product will survive the severe shock load impact of crash environments. This test was done for all six planes and takes into consideration all basic mounting possibilities. **Vibration** (Method 514.2, Procedure VIII, Tracked Vehicle, Curve W). A nine hour vibration test designed for tracked vehicles, with measurements in all three axes.
Code Plug Flexibility	The Trunked fleet and subfleet assignments are contained in a code plug located in the control head.	This makes it possible to reassign a mobile for operation in a different fleet or subfleet by simple replacement of the code plug. No additional tuning or adjustment is required.
Busy Light	A Busy Light gives visual indication that no voice channels are presently available. This light is located on the control head.	Activation of this light alerts the mobile operator that his call request has been placed in an ordered waiting line (queue), and he will automatically be "called back" once a channel becomes available.
Power	The Trunked Syntor X 35 watt transmitter sets the standard for the two-way radio industry in the 800 MHz band.	This provides extended communications coverage.
Antenna Switch	The Trunked Syntor X radio switches are sealed in glass in a special housing.	Has proven reliability for as many as 200 million operations without failure. Provides an extra margin of assurance against malfunction.
Time-Out Timer	Automatically shuts off the transmitter after a predetermined amount of time.	Prevents lock-up of a repeater, or tie-up of a channel by prolonged keying of the transmitter after the transmission has exceeded a preset time.

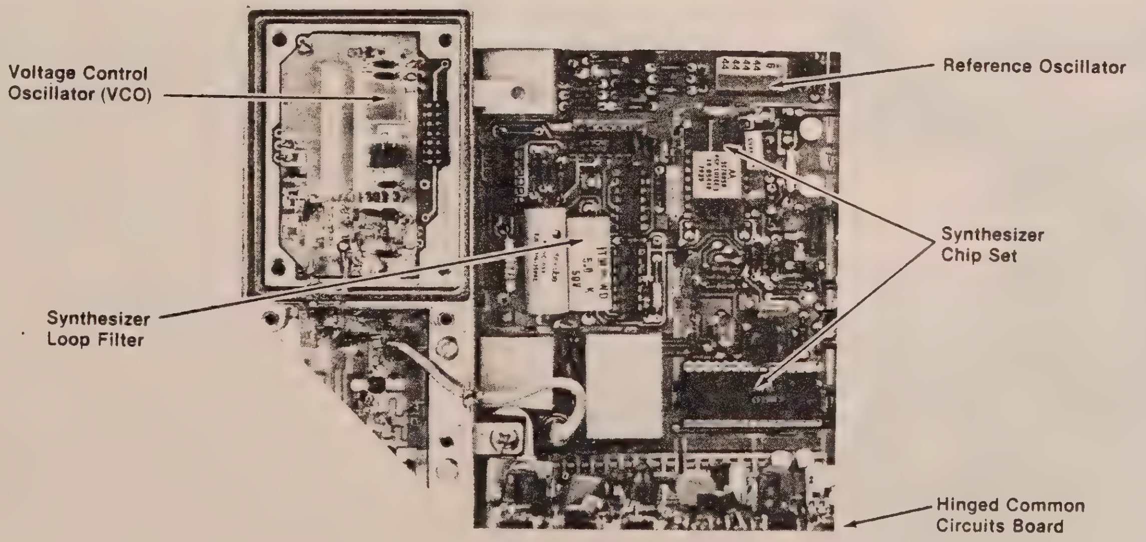
Feature	Description	Benefits
Compact Design	The Trunked Syntor X radio occupies only 460 cubic inches (7528 cubic centimeters) and weighs just 22.5 pounds (10.2 kg).	The Trunked mobile is less than ⅔ the size of the Trunked Micor mobile. This size reduction will facilitate easier mounting and installation. Front mounting is simplified with a 10′ cable option.
Radio Inter-Changeability	All programmable trunking customer information is contained in the control head. The radio package can be easily changed out with a new radio. It will automatically assume the former radio control head's programming characteristics and frequencies.	Simplifies field servicing and makes the stocking of spare radios for change-out of malfunctioning units very practical. Reduces system down time.
Simplified Maintenance	The Trunked Syntor X radio's servicing is accomplished with an internally located (in the radio) microprocessor program and a Micor test set. Access to to the radio is easy. A simple key turn permits radio removal from the mounting tray, and the top cover is removed with the push of a button.	Standard Motorola test equipment is compatible with the Trunked Syntor X radio. Easy access and fixed tuned operation simplify preventive maintenance.
Contemporary Design	The control head is of high impact plastic construction. It features illumination of subfleet button selection and backlighting for the remainder of control head lettering.	Control head is attractively designed. It is tough, durable, and easy to read.
Negative/ Positive Ground	The Trunked Syntor X radio has a floating ground.	The radio will operate from either a positive or negative ground without requiring a converter. The appropriate polarity cable is required.

Subfleet Select	Provides 5 pushbuttons mounted on control head which can be programmed for either one fleet call and 4 subfleet positions, or 5 subfleet with no fleet call.	Allows user to segment his operation for selective communications with distinct subgroups within his fleet. This subdivision of a fleet permits privacy to an individual subfleet level.
Volume Set	Since the mobile remains silent unless there is voice activity within its assigned fleet or subfleet, a volume set is available. This emits an audible tone by which an operator may set his desired audio level.	Allows for the setting of volume levels in the absence of any voice activity.

Trunked SYNTOR X Radio



Trunked SYNTOR X Synthesizer Circuitry



Trunked SYNTOR X FM Two-Way Radio

Performance Specifications

General Specifications

No. of Frequencies:	Twenty
Primary Power:	12V dc negative or positive ground. Radio is supplied for operation with negative ground vehicles. Optional cable kit permits operation with positive ground vehicles.
Dimensions:	2.5″ H x 11.5″ W x 16.0″ L (63.5 mm x 292 mm x 406 mm)
Weight:	Approx. 22.5 lbs. (10.2 kg) Ship Wt. approx. 37.5 lbs. (17 kg)
Metering:	A single-scale 0 to 50 microampere meter or Motorola Portable Test Set can be used to measure all circuits essential to adjustment and checking.

Freq. (MHz)	Model Number	EIA Intermittent Minimum Rf Power Output	Operation	Max. Batt. Drain		
				Stdby. @ 13.8V	Rcvr. @ 13.8V	Transmit @ 13.6V
806-825TX/ 851-870RX	T45VBJ5600AK	35W	±12V dc	1.1A	3.3A	13A

Transmitter

Output Impedance:	50 ohms
Spurious & Harmonics:	More than 85 dB below carrier (per EIA Spec RS152B)
Frequency Stability:	±.0002% of assigned center frequency from —40°C to +70°C ambient, (+25°C ref.)
Modulation:	15F2 and 16F3: ±5 kHz for 100% @ 1000 Hz
Audio Sensitivity:	0.080V ±3 dB for 60% max. deviation @ 1000 Hz
FM Hum and Noise: EIA Method	Companion Rcvr. Response —60 dB RS152B Response —50 dB
Audio Response:	+1, —3 dB of a 6 dB per octave pre-emphasis characteristic from 300 to 3000 Hz
Audio Distortion:	Less than 2% @ 1000 Hz, 60% max. deviation
Maximum Frequency Separation:	19 MHz
FCC Designation:	CC5023—licensable under FCC Rules Part 90 for 15F2, 16F3 and 16F9 emission

Receiver

Channel Spacing:	25 kHz
Sensitivity— 2 dB Quieting: EIA SINAD:	.35 µV .25 µV
Selectivity: (EIA SINAD)	—80 dB @ ±25 kHz —90 dB @ ±100 kHz
Intermodulation: (EIA SINAD)	—80 dB
Spurious and Image Rejection:	—100 dB
EIA Modulation Acceptance:	±7.5 kHz minimum
Input Impedance:	50 ohms
Audio Output:	15 watts at less than 3% distortion (into an 8 ohm load)
Maximum Frequency Separation:	19 MHz
Frequency Stability:	±.0002% of assigned center frequency from —40°C to +70°C ambient, (+25°C ref.)
FCC Designation:	RC0246

Speaker

Input Impedance:	8 ohms
Dimensions:	5″ x 5″ x 2½″ excluding mounting bracket (127 mm x 127 mm x 63 mm)
Weight:	1½ lbs. (680g)

Control Head

Dimensions: excluding mounting bracket	6⅞″ W x 2¼″ H x 5¾″ D (175 mm x 57 mm x 146 mm)
Weight:	1 lb. (453g)
Current Drain:	150 ma
Safety:	Meets or exceeds Federal Safety Standards FS-201 & SAEJ921

Transistorized Palm Type Microphone

Mounting:	Hang-up Brkt Included

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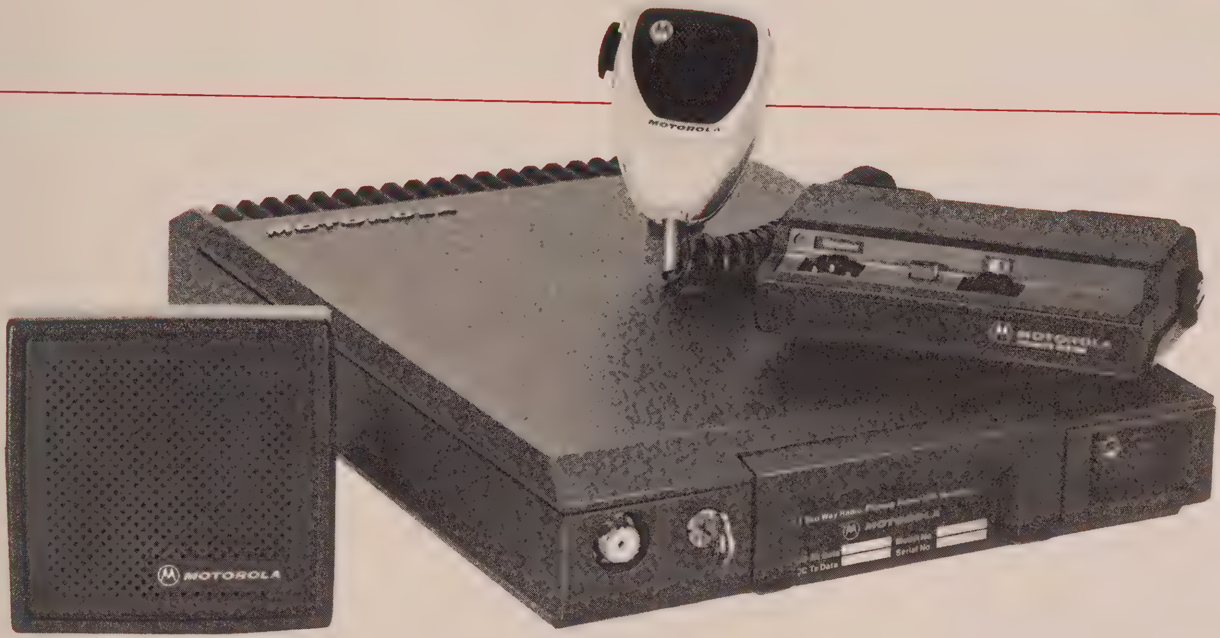
1301 East Algonquin Rd., Schaumburg, Illinois 60196
(312) 397-1000

Specifications Subject to Change Without Notice.

MOTOROLA

TRUNKED SYNTOR X2
FM Two-Way Radio

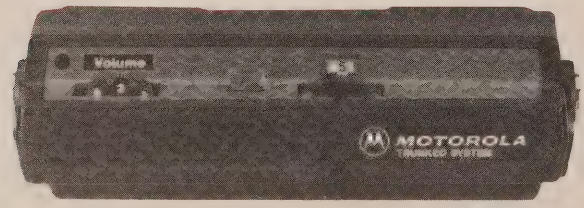
806-870 MHz
15/35 Watts



TRUNKED SYNTOR X2 FM Two-Way Radio

STANDARD

Feature	Description	Benefits
Trunked System Operation	The Trunked Syntor X 2 radio contains all the logic circuitry required to integrate this trunked mobile into a fully automatic trunked channel sharing system.	Motorola's Trunked Systems result in simplified mobile operation by the elimination of frequency selection, squelch controls, and monitoring requirements. They provide privacy from other system users, and up to 20 channel operation.
20 Channel Operation	The Trunked Syntor X 2 radio comes fully equipped for up to 20 channel operation.	20 channels expand communication capabilities by providing substantially more channels to handle call requests.
Fast-Lok Synthesizer	Specific RF frequencies are created electronically rather than by individual crystals or channel elements. The synthesizer spans the entire 800 MHz spectrum.	No channel elements are required. Synthesizer operation eliminates the need to return a radio for servicing to implement additional channels when the system grows in its number of frequencies. The radio will respond automatically to system frequency growth.
All Solid State	Transmitter, receiver, synthesizer and microprocessor control system are 100% solid state.	The Syntor X 2 radio provides full rated transmit and receive power at turn-on. Cooler operation allows longer component life, reducing maintenance in all systems.
Code Plug Flexibility	The Trunked fleet and subfleet assignments are contained in a code plug located in the radio.	This makes it possible to reassign a mobile for operation in a different fleet or subfleet by simple replacement of the code plug. No additional tuning or adjustment is required.
Power	The trunked SYNTOR X 2 radio is available in both 15 and 35 watt versions.	This choice of power levels allows you to tailor your system to your coverage requirements.
Antenna Switch	The Trunked Syntor X 2 radio switches are sealed in glass in a special housing.	Has proven reliability for as many as 200 million operations without failure. Provides an extra margin of assurance against malfunction.



"Syntor X 2" Control Head with subfleet select option

Standard "Syntor X 2" Control Head

Feature	Description	Benefits
Time-Out Timer	Automatically shuts off the transmitter after a predetermined amount of time.	Prevents lock-up of a repeater, or tie-up of a channel by prolonged keying of the transmitter after the transmission has exceeded a preset time.
Compact Design	The Trunked Syntor X 2 radio occupies only 460 cubic inches (7528 cubic centimeters) and weighs just 22.5 pounds (10.2 kg).	The Trunked mobile is less than ⅔ the size of the Trunked Micor mobile radio. This size reduction will facilitate easier mounting and installation. Front mounting is simplified with a 10 ft. cable option.
Simplified Maintenance	The Trunked Syntor X 2 radio's servicing is accomplished with an internal (in the radio) microprocessor program and a Micor test set. Access to the radio is easy. A simple key turn permits radio removal from the mounting tray, and the top cover is removed with the push of a button.	Standard Motorola test equipment is compatible with the Trunked Syntor X 2 radio. Easy access and fixed tuned operation simplify preventive maintenance.
Contemporary Design	The control head is of high impact plastic construction. It features backlighting for subfleet selection and volume control rotary switches.	Control head is attractively designed. It is tough, durable, and easy to read.
Simple Operation	The standard Trunked SYNTOR X 2 control head is equipped with on/off control, volume control and transmit light. An optional multiple subfleet selection control head is also available.	Easy, on-hands operation allows the operator to simply pick up the microphone and transmit.
Fleet Flexibility	The Trunked SYNTOR X 2 mobile radio is fully compatible in fleets presently using any Motorola trunked radios.	Provides 100% system compatibility, allowing you to choose whichever radio best suits your communications needs.
OPTIONS		
Subfleet Select	Provides a 5 position rotary switch mounted on control head which can be programmed for either one fleet call and 4 subfleet positions, or 5 subfleet with no fleet call.	Allows user to segment his operation for selective communications with distinct subgroups within his fleet. This subdivision of a fleet permits privacy to an individual subfleet level.
Accessory Interface	Substitutes System 90-type control head for standard control head.	Allows more sophisticated options such as expanded subfleet capability, volume set, and multiple code plug select.

TRUNKED SYNTOR X2 FM Two-Way Radio

Performance Specifications

General Specifications

No. of Frequencies:	Twenty
Primary Power:	12V dc negative ground
Dimensions:	2.5″ H x 11.5″ W x 16.0″ L (63.5 mm x 292 mm x 406 mm)
Weight:	Approx. 22.5 lbs. (10.2 kg) Ship Wt. approx. 37.5 lbs. (17 kg)
Metering:	A single-scale 0 to 50 microampere meter or Motorola Portable Test Set can be used to measure all circuits essential to adjustment and checking.

Freq. (MHz)	Model Number	EIA Intermittent Minimum Rf Power Output	Operation	Max. Batt. Drain		
				Stdby. @ 13.8V	RCVR. @ 13.8V	Transmit @ 13.8V
806-825TX/ 851-870RX	T35VBJ5G00	15W	12V dc neg. grd.	1.1A	3.3A	8A
	T45VSJ5G00	35W				13A

Transmitter

Output Impedance:	50 ohms
Spurious & Harmonics:	More than 80 dB below carrier (per EIA Spec RS152B)
Frequency Stability:	±.0002% of assigned center frequency from −30°C to +60°C ambient, (+25°C ref.)
Modulation:	15F2 and 16F3: ±5 kHz for 100% @ 1000 Hz
Audio Sensitivity:	0.080V ±3dB for 60% max. deviation @ 1000 Hz
Audio Response:	+1, −3 dB of a 6 dB per octave pre-emphasis characteristic from 300 to 3000 Hz
Audio Distortion:	Less than 2% @ 1000 Hz, 60% max. deviation
Maximum Frequency Separation:	19 MHz
FCC Designation:	15W:CC5041 35W:CC5023 licensable under FCC Rules Part 90 for 15F2, 16F3 and 16F9 emission

Receiver

Channel Spacing:	25 kHz
Sensitivity—	
20 dB Quieting:	.50 μV
EIA SINAD:	.35 μV
Selectivity: (EIA SINAD)	75 dB @ ± 25 kHz
Intermodulation: (EIA SINAD)	−70 dB
Spurious and Image Rejection:	−90 dB
EIA Modulation Acceptance:	±7.0 kHz minimum
Input Impedance:	50 ohms
Audio Output:	5 watts at less than 5% distorion
Maximum Frequency Separation:	19 MHz
Frequency Stability:	±.0002% of assigned center frequency from −30°C to +60°C ambient, (+25°C ref.)
FCC Designation:	RC0246

Speaker

Dimensions:	5″ x 5″ x2½″ excluding mounting bracket (127 mm x 127 mm x 63 mm)
Weight:	1½ lbs. (680g)

Control Head

Dimensions: excluding mounting bracket	6⅞″ W x 2″ H x 3¾″D (175 mm x 51 mm x 95 mm)
Weight:	1 lb. (453g)
Current Drain:	75 ma
Safety:	Meets or exceeds Federal Safety Standard FS-201 & SAEJ921

Transistorized Palm Type Microphone

Mounting:	Hang-up Brkt included

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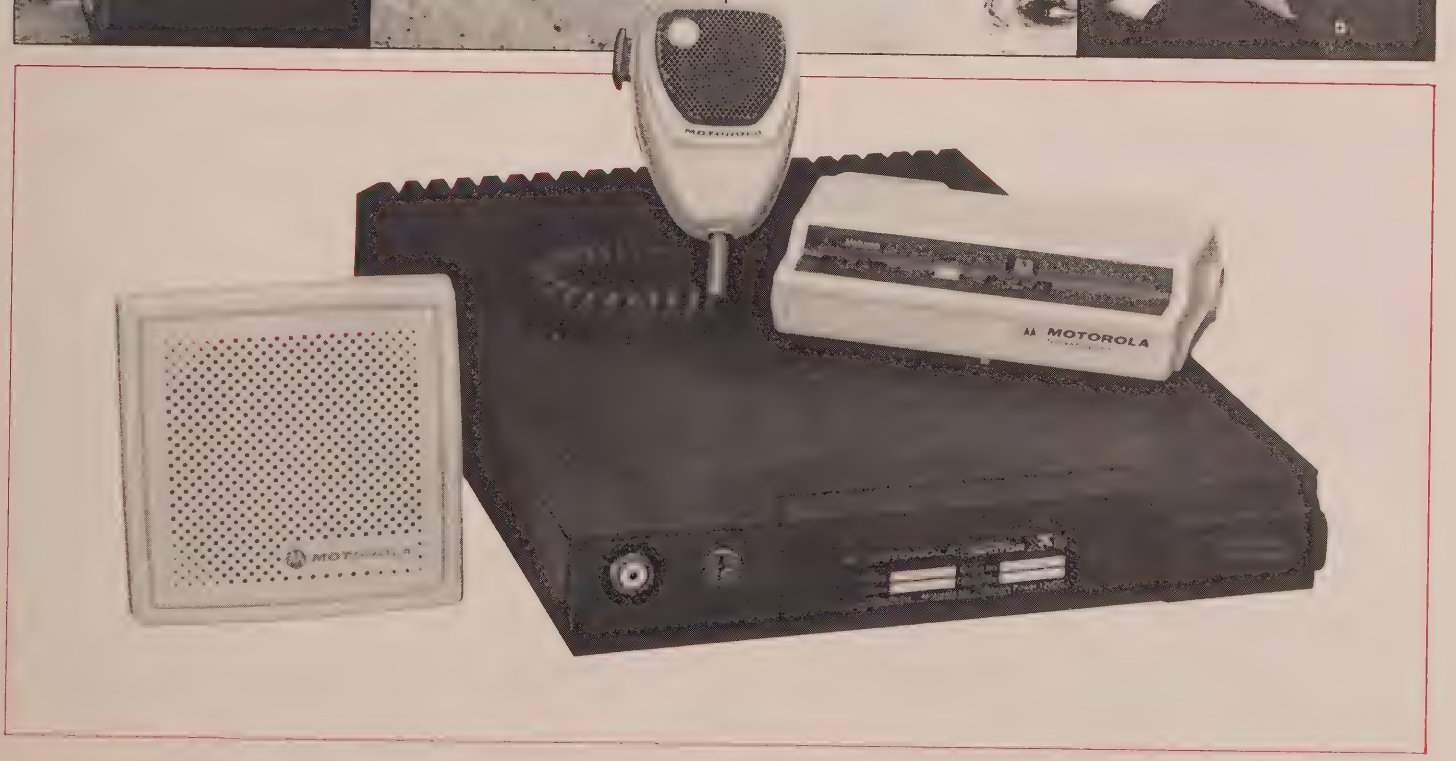
TRUNKED SYNTOR X3

FM Two-Way Radio

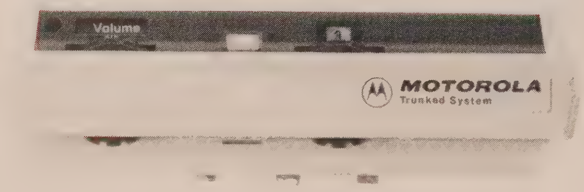
TX: 816-821 MHz
RX: 861-866 MHz
15/35 Watts



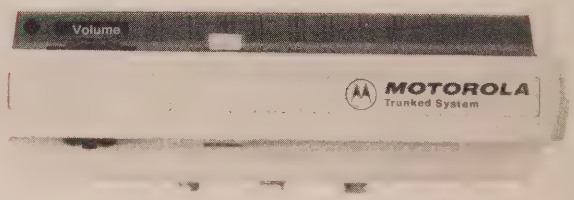
TRUNKED SYNTOR X 3 FM Two-Way Radio

STANDARD

Feature	Description	Benefits
Trunked System Operation	The Trunked Syntor X 3 radio contains all the logic circuitry required to integrate this trunked mobile into a fully automatic trunked channel sharing system.	Motorola's Trunked Systems result in simplified mobile operation by the elimination of frequency selection, squelch controls, and monitoring requirements. They provide privacy from other system users, and up to 20 channel operation.
20 Channel Operation	The Trunked Syntor X 3 radio comes fully equipped for up to 20 channel operation.	20 channels expand communication capabilities by providing substantially more channels to handle call requests.
Fast-Lok Synthesizer	Specific RF frequencies are created electronically rather than by individual crystals or channel elements. The synthesizer spans the entire 800 MHz spectrum.	No channel elements are required. Synthesizer operation eliminates the need to return a radio for servicing to implement additional channels when the system grows in its number of frequencies. The radio will respond automatically to system frequency growth.
All Solid State	Transmitter, receiver, synthesizer and microprocessor control system are 100% solid state.	The Syntor X 3 radio provides full rated transmit and receive power at turn-on. Cooler operation allows longer component life, reducing maintenance in all systems.
Power	The trunked Syntor X 3 radio is available in both 15 and 35 watt versions.	This choice of power levels allows you to tailor your system to your coverage requirements.
Code Plug Flexibility	The Trunked fleet and subfleet assignments are contained in a code plug located in the radio.	This makes it possible to reassign a mobile for operation in a different fleet or subfleet by simple replacement of the code plug. No additional tuning or adjustment is required.
Antenna Switch	The Trunked Syntor X 3 radio switches are sealed in glass in a special housing.	Has proven reliability for as many as 200 million operations without failure. Provides an extra margin of assurance against malfunction.



"Syntor X 3" Control Head with subfleet select option



Standard "Syntor X 3" Control Head

Feature	Description	Benefits
Time-Out Timer	Automatically shuts off the transmitter after a predetermined amount of time.	Prevents lock-up of a repeater, or tie-up of a channel by prolonged keying of the transmitter after the transmission has exceeded a preset time.
Compact Design	The Trunked Syntor X 3 radio occupies only 460 cubic inches (7528 cubic centimeters) and weighs just 22.5 pounds (10.2 kg).	The Trunked mobile is less than ⅔ the size of the Trunked Micor mobile radio. This size reduction will facilitate easier mounting and installation. Front mounting is simplified with a 10 ft. cable option.
Simplified Maintenance	The Trunked Syntor X 3 radio's servicing is accomplished with a built in microprocessor program and a Micor test set. Access to the radio is easy. A simple key turn permits radio removal from the mounting tray, and the top cover is removed with the push of a button.	Standard Motorola test equipment is compatible with the Trunked Syntor X 3 radio. Easy access and fixed tuned operation simplify preventive maintenance.
Rugged Styling	The control head is of high impact plastic construction. It features backlighting for subfleet selection, volume control and on/off switches.	Control head is attractively designed. It is tough, durable, and easy to read.
Simple Operation	The standard Trunked Syntor X 3 control head is equipped with on/off control, volume control and transmit light. An optional multiple subfleet selection control head is also available.	Easy, straightforward operation allows the operator to simply pick up the microphone and transmit.
Fleet Flexibility	The Trunked Syntor X 3 mobile radio is fully compatible in fleets presently using any Motorola trunked radios.	Provides 100% system compatibility, allowing you to choose whichever radio best suits your communications needs.
OPTIONS		
Subfleet Select	Provides a 5 position rotary switch mounted on control head which can be programmed for either one fleet call and 4 subfleet positions, or 5 subfleets with no fleet call.	Allows user to segment his operation for selective communications with distinct subgroups within his fleet. This subdivision of a fleet permits privacy to an individual subfleet level.

TRUNKED SYNTOR X3 FM Two-Way Radio

Performance Specifications

General Specifications

No. of Frequencies:	Twenty
Primary Power:	12V dc negative ground.
Dimensions:	2.5″ H x 11.5″ W x 16.0″ L (63.5 mm x 292 mm x 406 mm)
Weight:	Approx. 22.5 lbs. (10.2 kg) Ship Wt. approx. 37.5 lbs. (17 kg)
Metering:	A single-scale 0 to 50 microampere meter or Motorola Portable Test Set can be used to measure all circuits essential to adjustment and checking.

Freq. (MHz)	Model Number	EIA Intermittent Minimum Rf Power Output	Operation	Max. Batt. Drain		
				Stdby. @ 13.8V	RCVR. @ 13.8V	Transmit @ 13.8V
816-821TX 861-866RX	T35VUJ5G00 T45VUJ5G00	15W 35W	12V dc neg. grd.	1.1A 1.1A	3.3A 3.3A	8.0A 13.0A

Transmitter

Output Impedance:	50 ohms
Spurious & Harmonics:	More than 60 dB below carrier (per EIA Spec RS152B)
Frequency Stability:	± .00025% of assigned center frequency from −30°C to +60°C ambient. (+25°C ref.)
Modulation:	15F2 and 16F3: ±5 kHz for 100% @ 1000 Hz
Audio Sensitivity:	0.080V ±3dB for 60% max. deviation @ 1000 Hz
Audio Response:	+1, −3 dB of a 6 dB per octave pre-emphasis characteristic from 300 to 3000 Hz
Audio Distortion:	Less than 2% @ 1000 Hz. 60% max. deviation
Maximum Frequency Separation:	19 MHz
FCC Designation:	35W:CC5023 15W:CC5041 licensable under FCC Rules Part 90 for 15F2, 16F3 and 16F9 emission

Receiver

Channel Spacing:	25 kHz
Sensitivity—	
20 dB Quieting:	.40 μV
EIA SINAD:	.30 μV
Selectivity: (EIA SINAD)	75 dB @ ± 25 kHz
Intermodulation: (EIA SINAD)	−70 dB
Spurious and Image Rejection:	−70 dB
EIA Modulation Acceptance:	±7.0 kHz minimum
Input Impedance:	50 ohms
Audio Output:	3 watts at less than 5% distorion
Maximum Frequency Separation:	5 MHz
Frequency Stability:	± .00025% of assigned center frequency from −30°C to +60°C ambient. (+25°C ref.)
FCC Designation:	RC0246

Speaker

Dimensions:	5″ x 5″ x 2½″ excluding mounting bracket (127 mm x 127 mm x 63 mm)
Weight:	1½ lbs. (680g)

Control Head

Dimensions: (excluding mounting bracket)	6⅞″ W x 2″ H x 3¾″D (175 mm x 51 mm x 95 mm)
Weight:	1 lb. (453g)
Current Drain:	75 ma
Safety:	Meets or exceeds Federal Safety Standard FS-201 & SAEJ921

Transistorized Palm Type Microphone

Mounting:	Hang-up Brkt included

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Eq. Cat.	Sec.	Item
R3	8.7	01

MOTOROLA

Trunked SYNTOR X FM Radio Control Station

806-870 MHz
10 Watts

Trunked SYNTOR X FM Radio Control Station

STANDARD

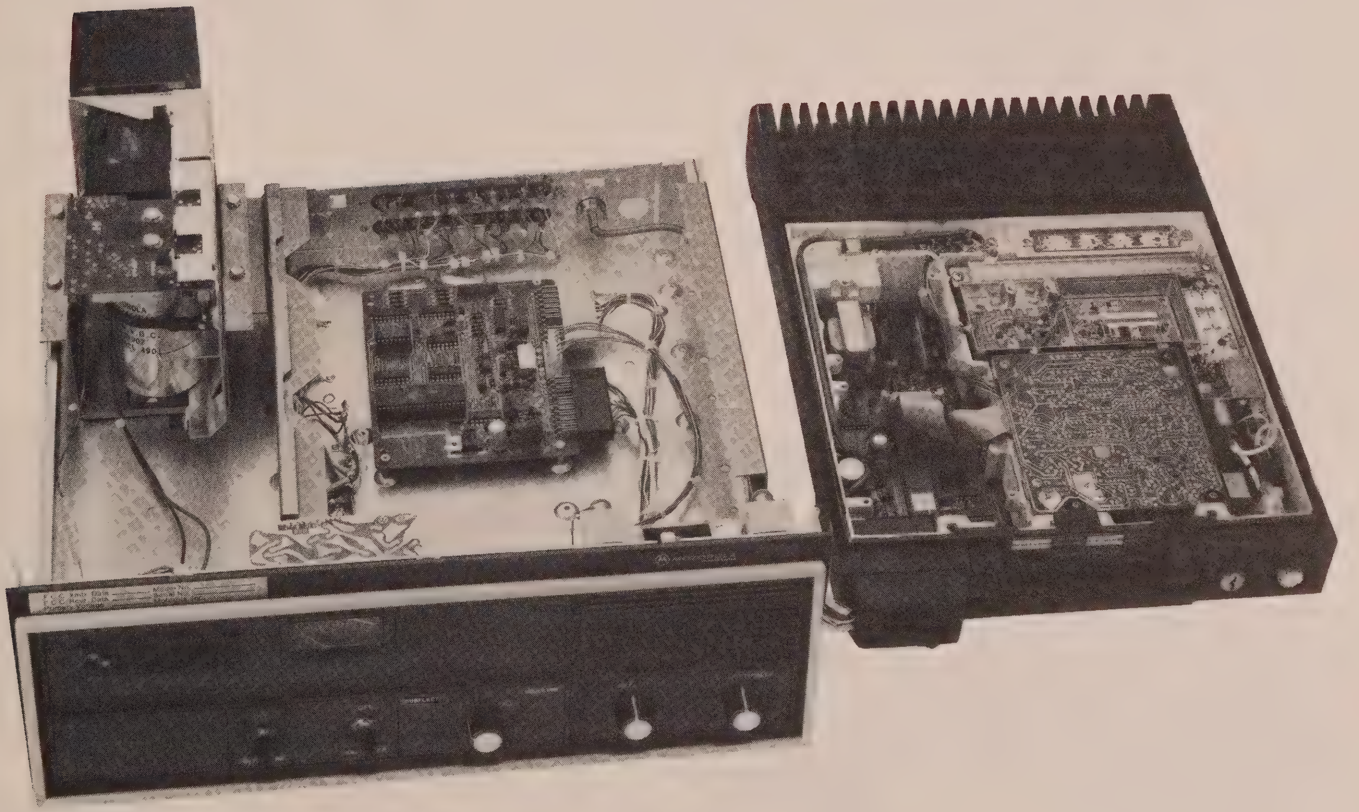
Feature	Description	Benefits
Trunked System Operation	The Trunked Syntor X control station contains all the logic circuitry required to integrate this high performance radio into a fully automatic channel sharing trunked system.	Motorola's Trunked Systems result in simplified user operation through the elimination of frequency selection, squelch controls, and monitoring requirements. They provide privacy from other system users, and up to 20 channel operation.
20 Channel Operation	The Trunked Syntor X control station comes fully equipped with up to 20 channel operation.	20 channels expand communications capabilities by providing substantially more channels to handle call requests.
Fast-Lok Synthesizer	Specific RF Frequencies are created electronically rather than by individual crystals or channel elements. The synthesizer spans the entire 800 MHz spectrum.	No channel elements are required. Synthesizer operation eliminates the need to return the control station for servicing to implement additional channels when the system grows in its number of frequencies. The control station will respond automatically to system frequency growth.
Premium Performance Specifications	The Trunked Syntor X control station features less than 2% audio distortion with spurs and harmonics at —85 dB, and .0002 frequency stability at —30°C to +60°C.	Transmissions will be sharp and clear with a minimum of transmitter generated noise. Transmissions will remain on frequency regardless of extreme temperature conditions.
Receiver Excellence	The Trunked Syntor X control station receiver features —80 dB intermodulation protection, —80 dB selectivity at the first adjacent channel, and a built-in preamp providing sensitivity of .25 μv (EIA SINAD).	Provides a clear signal in high RF density areas. Adjacent channel interference is minimized. Receives even extremely weak transmissions for improved distance coverage.
Solid State	The Trunked Syntor X control station's transmitter, receiver, synthesizer, power supply and microprocessor control system are 100% solid state.	Solid state components provide greater reliability and equipment durability.
Operational Flexibility	Available in local and extended control configurations.	You can choose the configuration that best suits your dispatching needs.

Local Control—for desktop installation, contains all control functions on the front panel. Matching desk microphone is provided.

Extended Local Control—use the standard desk microphone for local control or use the optional Series 80 Local Desk Set for extended local control to serve as radio "dispatch points" up to 100 cable feet from the control station.

SERVICEABILITY

Feature	Description	Benefits
Connections	All input and output connections, including AC power and antenna, are at the rear of the unit.	Servicing can be performed without disturbing the connectors.
Modular	The radio module can be lifted out of the station chassis for servicing while still connected.	Provides the technician with complete access to the unit while it is in operating condition.
Front Panel	The front panel can be pivoted down.	Provides access to all the local controls.
Metering	Full metering socket capability.	Simplifies tuning.
Service Intercom	Service intercom is available on an optional basis.	Provides communications between the station and its control point.



Trunked SYNTOR X FM Radio Control Station

STANDARD

Feature	Description	Benefits
Trunked System Operation	The Trunked Syntor X control station contains all the logic circuitry required to integrate this high performance radio into a fully automatic channel sharing trunked system.	Motorola's Trunked Systems result in simplified user operation through the elimination of frequency selection, squelch controls, and monitoring requirements. They provide privacy from other system users, and up to 20 channel operation.
20 Channel Operation	The Trunked Syntor X control station comes fully equipped with up to 20 channel operation.	20 channels expand communications capabilities by providing substantially more channels to handle call requests.
Fast-Lok Synthesizer	Specific RF Frequencies are created electronically rather than by individual crystals or channel elements. The synthesizer spans the entire 800 MHz spectrum.	No channel elements are required. Synthesizer operation eliminates the need to return the control station for servicing to implement additional channels when the system grows in its number of frequencies. The control station will respond automatically to system frequency growth.
Premium Performance Specifications	The Trunked Syntor X control station features less than 2% audio distortion with spurs and harmonics at —85 dB, and .0002 frequency stability at —30°C to +60°C.	Transmissions will be sharp and clear with a minimum of transmitter generated noise. Transmissions will remain on frequency regardless of extreme temperature conditions.
Receiver Excellence	The Trunked Syntor X control station receiver features —80 dB intermodulation protection, —80 dB selectivity at the first adjacent channel, and a built-in preamp providing sensitivity of .25 μv (EIA SINAD).	Provides a clear signal in high RF density areas. Adjacent channel interference is minimized. Receives even extremely weak transmissions for improved distance coverage.
Solid State	The Trunked Syntor X control station's transmitter, receiver, synthesizer, power supply and microprocessor control system are 100% solid state.	Solid state components provide greater reliability and equipment durability.
Operational Flexibility	Available in local and extended control configurations.	You can choose the configuration that best suits your dispatching needs.

Local Control—for desktop installation, contains all control functions on the front panel. Matching desk microphone is provided.

Extended Local Control—use the standard desk microphone for local control or use the optional Series 80 Local Desk Set for extended local control to serve as radio "dispatch points" up to 100 cable feet from the control station.

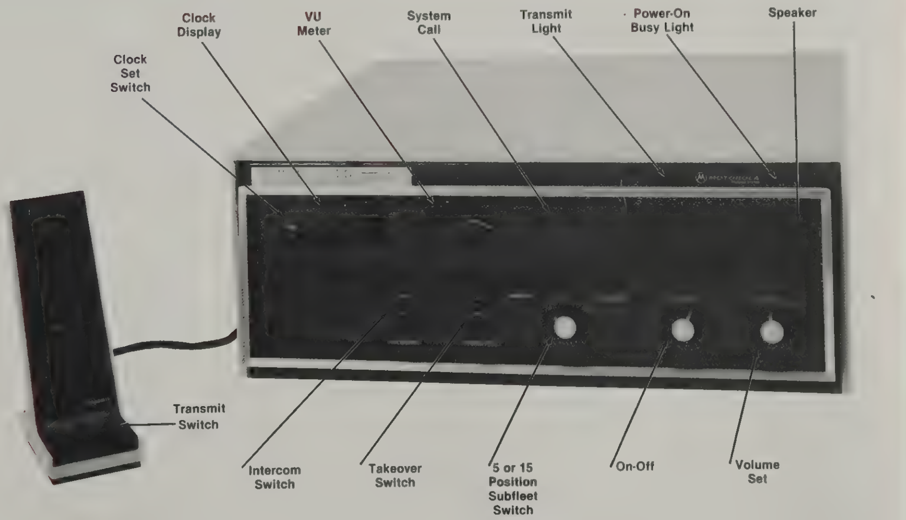
Trunked SYNTOR X FM Radio Control Station

Feature	Description	Benefits
Trunked System Operation	The Trunked Syntor X control station contains all the logic circuitry required to integrate this high performance radio into a fully automatic channel sharing trunked system.	Motorola's Trunked Systems result in simplified user operation through the elimination of frequency selection, squelch controls, and monitoring requirements. They provide privacy from other system users, and up to 20 channel operation.
20 Channel Operation	The Trunked Syntor X control station comes fully equipped with up to 20 channel operation.	20 channels expand communications capabilities by providing substantially more channels to handle call requests.
Fast-Lok Synthesizer	Specific RF Frequencies are created electronically rather than by individual crystals or channel elements. The synthesizer spans the entire 800 MHz spectrum.	No channel elements are required. Synthesizer operation eliminates the need to return the control station for servicing to implement additional channels when the system grows in its number of frequencies. The control station will respond automatically to system frequency growth.
Premium Performance Specifications	The Trunked Syntor X control station features less than 2% audio distortion with spurs and harmonics at —85 dB, and .0002 frequency stability at —30°C to +60°C.	Transmissions will be sharp and clear with a minimum of transmitter-generated noise. Transmissions will remain on frequency regardless of extreme temperature conditions.
Receiver Excellence	The Trunked Syntor X control station receiver features —80 dB intermodulation protection, —80 dB selectivity at the first adjacent channel, and a built-in preamp providing sensitivity of .25 μv (EIA SINAD).	Provides a clear signal in high RF density areas. Adjacent channel interference is minimized. Receives even extremely weak transmissions for improved distance coverage.
Solid State	The Trunked Syntor X control station's transmitter, receiver, synthesizer, power supply and microprocessor control system are 100% solid state.	Solid state components provide greater reliability and equipment durability.
Operational Flexibility	Available in local and extended control configurations.	You can choose the configuration that best suits your dispatching needs.

Local Control—for desktop installation, contains all control functions on the front panel. Matching desk microphone is provided.

Extended Local Control—use the standard desk microphone for local control or use the optional Series 80 Local Desk Set for extended local control to serve as radio "dispatch points" up to 100 cable feet from the control station.

Feature	Description	Benefits
Code Plug Flexibility	The Trunked Syntor X control station fleet and subfleet configurations are contained in a code plug mounted in the Trunking Control Logic module.	This makes it possible to reassign a control station to a different fleet or subfleet by simple replacement of the code plug. No additional tuning or adjustment is required.
Time-Out Timer	Automatically shuts off the transmitter after a pre-determined period of time.	Prevents lock-up of a repeater, or the tie-up of a channel by the inadvertent or prolonged keying of the transmitter. Emits an audible tone in advance of shutting down the transmitter after the transmission has exceeded a preset time.
Busy Indication	Provided standard on all Trunked Syntor X control stations. Gives a visual indication that no voice channels are presently available. A flashing green on/off light indicates this condition.	Activation of this light alerts the operator that his call request has been placed in an ordered waiting line (queue) and he will automatically be called back once a channel becomes available.
Compact Stylish Design	The Trunked Syntor X control station is small, lightweight, and contemporary in its styling.	Makes it a welcome addition to the decor of any office. Can easily be installed on a desk, tabletop, or shelf.



Feature	Description	Benefits
Subfleet Selector	Choice of two subfleet selector options One is a six-position selector which provides one fleet-call position and up to 5 subfleet positions. The second option is a 16 position selector switch which offers one fleet call position and up to 15 subfleets.	Provides maximum flexibility to structure and organize a customer's operation within a fleet and numerous subfleets for added segmentation.
System Call	A panel mounted switch allows the control station to transmit a message to virtually every unit of every fleet in its Trunked System. This option is reserved exclusively for the Trunked System owner.	Provides the system owner's dispatcher a means of disseminating urgent, important information to all users in the Trunked System.
Control Point and Intercom Kit	Provides the control point supervisory switch and intercom required by the FCC, between dispatch points and the Trunked control station.	The intercom option provides a convenient method of communications to additional dispatch points
Panel Mounted Operational Accessories	Twelve or 24-hour digital clock with light emitting diode (LED) readouts, aids with station or message log; stylish adaptation to any office. VU meter provides instant identification of microphone audio levels, helps dispatcher maintain proper speaker distance.	These convenience options help the dispatcher optimize the efficiency of the system
100/220/240 AC	The Trunked Syntor X control station can be operated from any of these additional power sources.	Ideal for applications where primary sources of AC power may vary.
DC Only Operation	Operates from 12V dc battery source, only.	Provides a cost-effective alternative when AC power is not available.

Trunked SYNTOR X FM Radio Control Station

Performance Specifications

General

Model No.	Frequency MHz	Maximum RF Output Power	Input Voltage	AC Current Drain (@ 121V, 60 Hz)		DC Current Drain @ 13.6V	
				Standby	Transmit	Standby	Transmit
L35VBB5174AM	806-870	10W	120V ac @ 60 Hz (100/220/240V ac Opt.) (12V dc Opt.)	.25A	2A	1.2A	7A

No. of Frequencies:	Twenty.
Dimensions:	6⅞" high x 16¾" wide x 22¼" long. (175 x 425 x 565 mm)
Weight:	Approximately 53 lbs. (24 kg.) Shipping weight, including accessories: approx. 57 lbs. (28 kg.).

Transmitter 806-825 MHz

RF Power Output:	10 W Var to 3 W
Output Impedance:	50 ohms
Spurious and Harmonic Emissions:	—85 dB
Frequency Stability:	±.0002% from —30°C to +60°C ambient +25°C ref. ±15% primary voltage variation
Maximum Frequency Separation:	19 MHz
Modulation:	15F2 and 16F3: ±5 kHz for 100% @ 1000 Hz
Audio Sensitivity:	0.080 V ±3 dB for 60% max. deviation @ 1000 Hz
FM Noise EIA Method:	Companion Rcvr. Response —60 dB RS152B Response —50 dB
Audio Response:	+1, —3 dB of 6 dB/octave preemphasis characteristic from 300 to 3000 Hz
Audio Distortion:	Less than 2% @ 1000 Hz, 60% maximum deviation
FCC Designation:	CC5031—licensable under FCC Rules Part 90 for 15F2, 16F3 and 16F9 emission.

Receiver 851-870 MHz

Channel Spacing:	25 kHz
EIA Modulation Acceptance:	±7.0 kHz min.
Selectivity—EIA-SINAD:	±25 kHz: —80 dB ±100 kHz: —90 dB
Frequency Stability:	Within ±.0002% from —30°C to +60°C ambient, +25°C ref. ±15% primary voltage variation
Maximum Frequency Separation:	19 MHz
Input Impedance:	50 ohms
Sensitivity— 20 dB Quieting:	.35 μV
EIA SINAD:	.25 μV
Intermodulation— EIA SINAD:	—80 dB
Spurious & Image Rejection:	—100 dB
Audio Characteristics For Local Speaker Output:	5W at (16 Ω)
Response:	+2, —8 dB of 6 dB/octave deemphasis characteristic from 300 to 3000 Hz
Distortion:	Less than 5% at 1000 Hz
Hum & Noise:	—50 dB
FCC Designation:	RC0246

NATIONAL MOTOROLA COMMUNICATIONS SERVICE

Support Services

Wherever Motorola sells, our product is backed by service. In the U.S., we have 900 authorized or company-owned centers. In addition, our products are serviced throughout the world by a wide network of company or authorized independent distributor service organizations.

MOTOROLA
Communications and Electronics Inc.
A subsidiary of Motorola, Inc.
1301 E. Algonquin Road, Schaumburg, Illinois 60196
Telephone (312) 397-1000

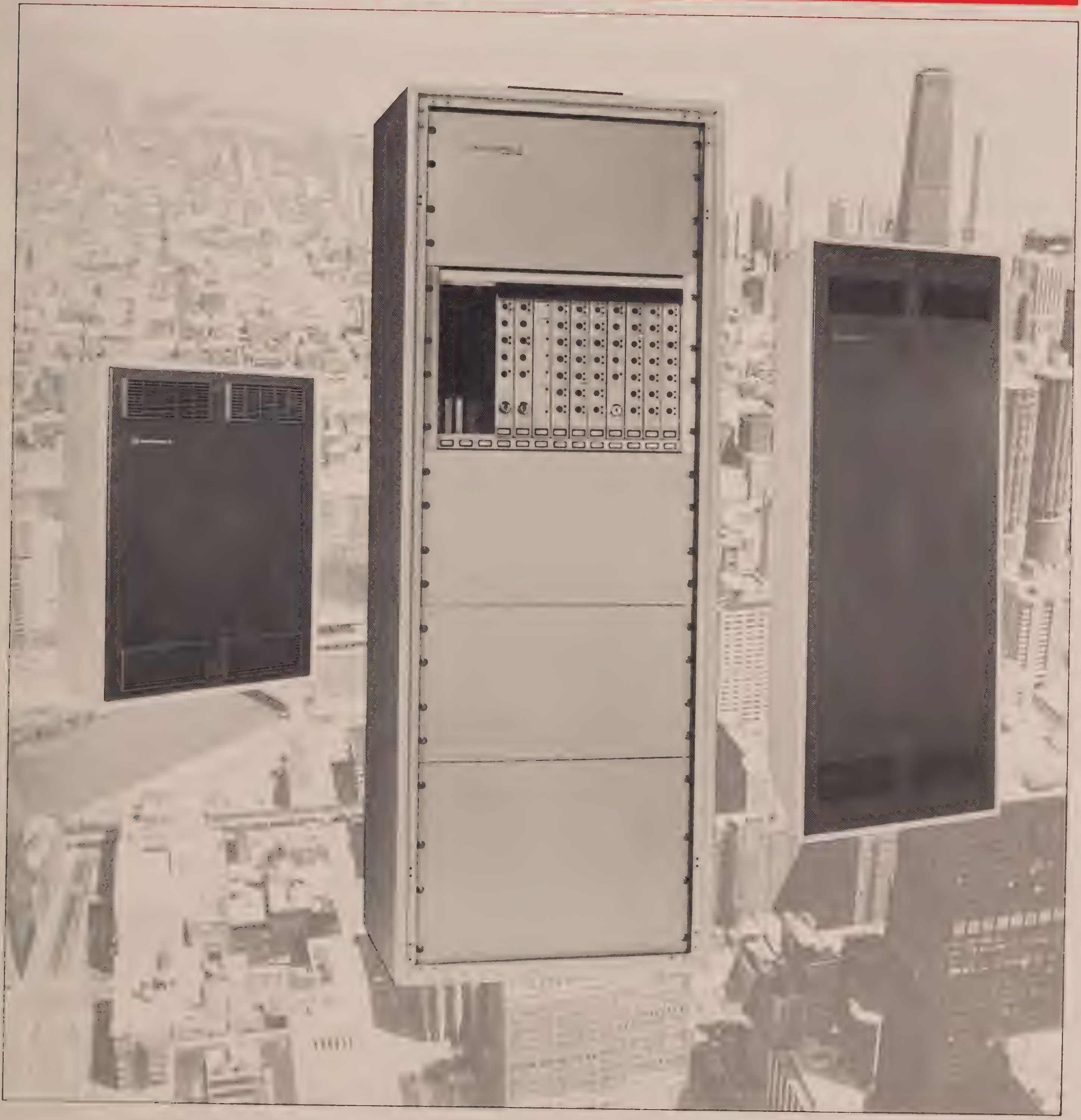
Specifications subject to change without notice.

MOTOROLA

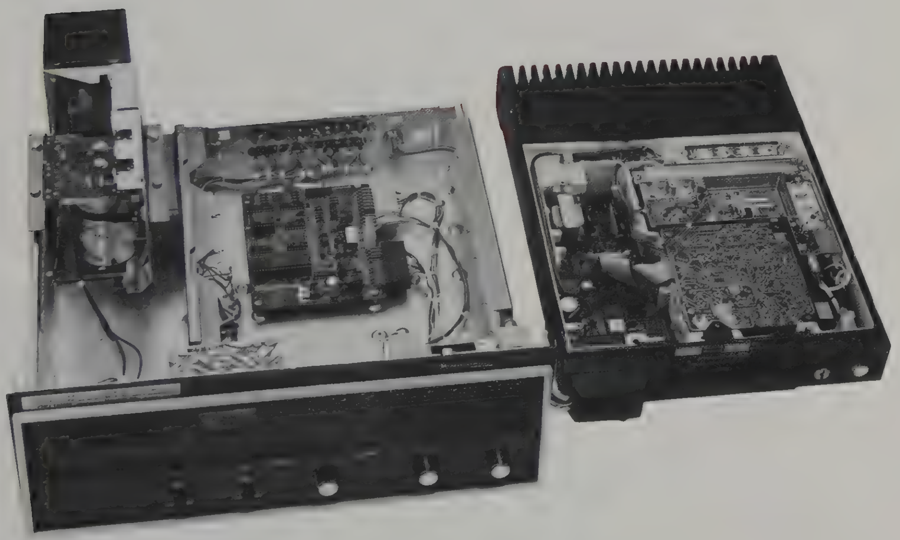
Trunked Radio Systems

- Central Controller
- Trunked Repeaters 35/70/125 Watts

806-870 MHz



Feature	Description	Benefits
Connections	All input and output connections, including AC power and antenna, are at the rear of the unit.	Servicing can be performed without disturbing the connectors.
Modular	The radio module can be lifted out of the station chassis for servicing while still connected.	Provides the technician with complete access to the unit while it is in operating condition.
Front Panel	The front panel can be pivoted down.	Provides access to all the local controls.
Metering	Full metering socket capability.	Simplifies tuning.
Service Intercom	Service intercom is available on an optional basis.	Provides communications between the station and its control point.



Trunked SYNTOR X FM Radio Control Station

Performance Specifications

General

Model No.	Frequency MHz	Maximum RF Output Power	Input Voltage	AC Current Drain (@ 121V, 60 Hz)		DC Current Drain @ 13.6V	
				Standby	Transmit	Standby	Transmit
L35VBB5174AM	806-870	10W	120V ac @ 60 Hz (100/220/240V ac Opt.) (12V dc Opt.)	.25A	2A	1.2A	7A

No. of Frequencies:	Twenty.
Dimensions:	6⅞″ high x 16¾″ wide x 22¼″ long. (175 x 425 x 565 mm)
Weight:	Approximately 53 lbs. (24 kg.) Shipping weight, including accessories: approx. 57 lbs. (28 kg.).

Transmitter 806-825 MHz

RF Power Output:	10 W Var to 3 W
Output Impedance:	50 ohms
Spurious and Harmonic Emissions:	—85 dB
Frequency Stability:	±.0002% from —30°C to +60°C ambient +25°C ref. ±15% primary voltage variation
Maximum Frequency Separation:	19 MHz
Modulation:	15F2 and 16F3: ±5 kHz for 100% @ 1000 Hz
Audio Sensitivity:	0.080 V ±3 dB for 60% max. deviation @ 1000 Hz
FM Noise EIA Method:	Companion Rcvr. Response —60 dB RS152B Response —50 dB
Audio Response:	+1, —3 dB of 6 dB/octave preemphasis characteristic from 300 to 3000 Hz
Audio Distortion:	Less than 2% @ 1000 Hz, 60% maximum deviation
FCC Designation:	CC5031—licensable under FCC Rules Part 90 for 15F2, 16F3 and 16F9 emission.

Receiver 851-870 MHz

Channel Spacing:	25 kHz
EIA Modulation Acceptance:	±7.0 kHz min.
Selectivity—EIA-SINAD:	±25 kHz: —80 dB ±100 kHz: —90 dB
Frequency Stability:	Within ±.0002% from —30°C to +60°C ambient, +25°C ref. ±15% primary voltage variation
Maximum Frequency Separation:	19 MHz
Input Impedance:	50 ohms
Sensitivity—20 dB Quieting:	.35 μV
EIA SINAD:	.25 μV
Intermodulation—EIA SINAD:	—80 dB
Spurious & Image Rejection:	—100 dB
Audio Characteristics For Local Speaker Output:	5W at (16 Ω)
Response:	+2, —8 dB of 6 dB/octave deemphasis characteristic from 300 to 3000 Hz
Distortion:	Less than 5% at 1000 Hz
Hum & Noise:	—50 dB
FCC Designation:	RC0246

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(8102) Merit

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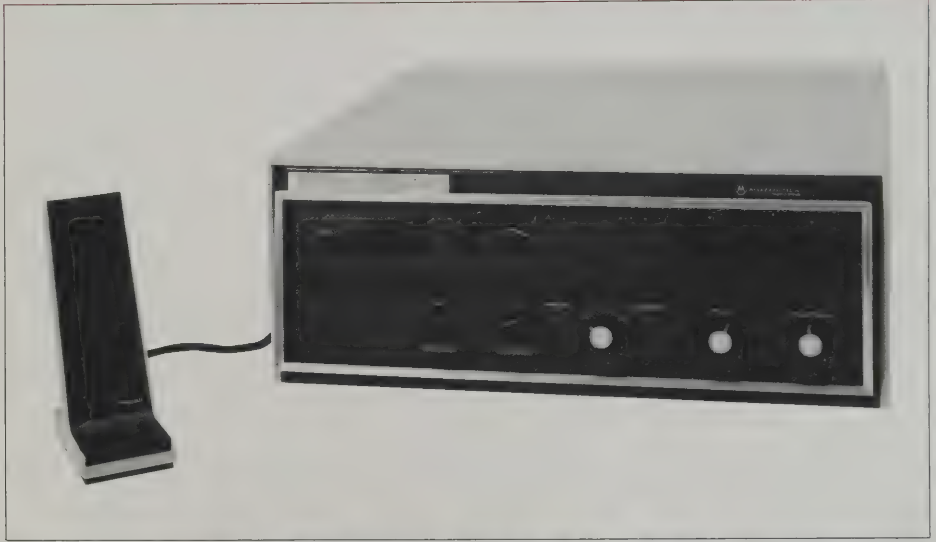
MOTOROLA

Trunked SYNTOR X FM Radio Control Station

806-870 MHz
10 Watts

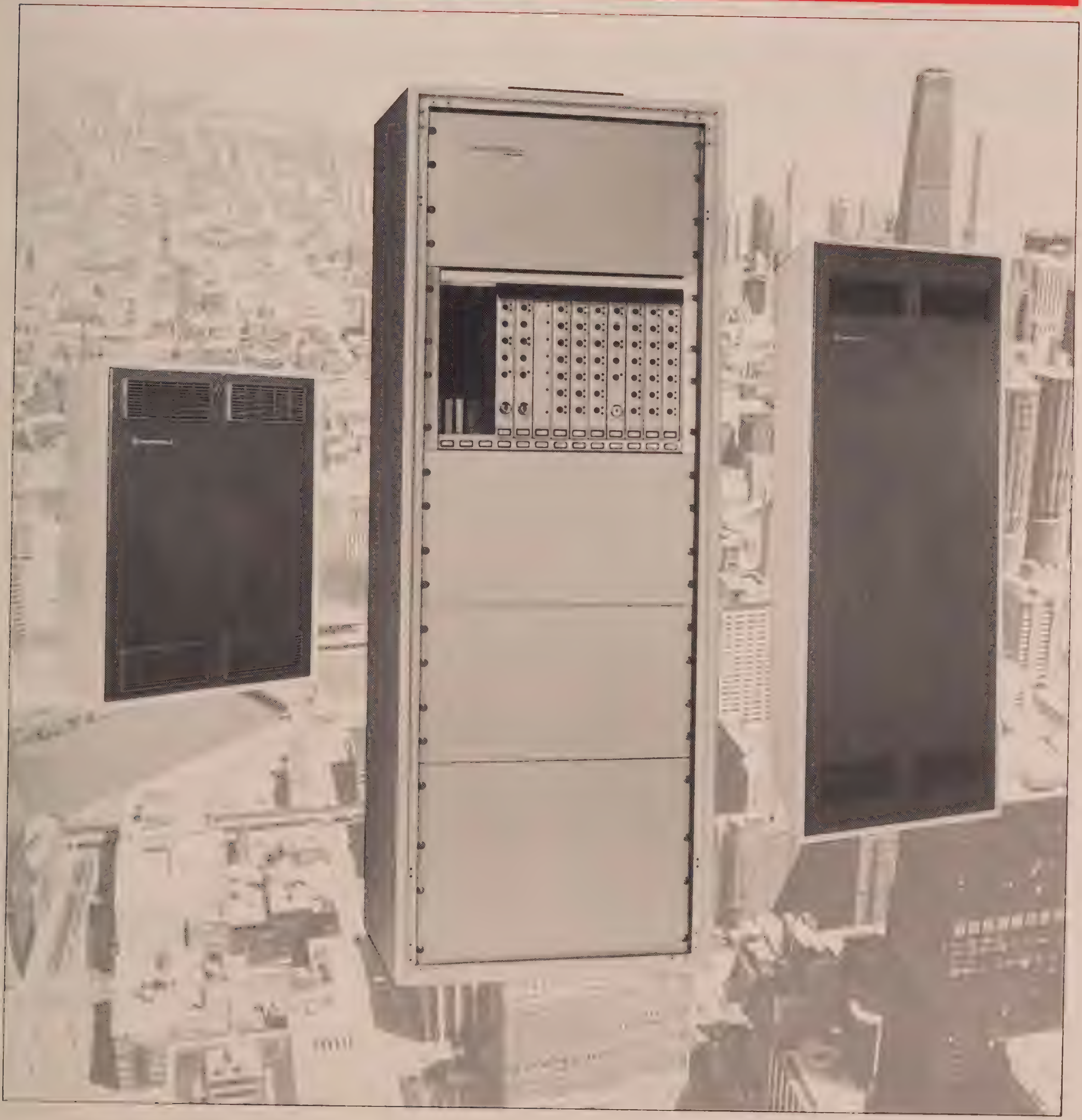


MOTOROLA

Trunked Radio Systems

- Central Controller
- Trunked Repeaters 35/70/125 Watts

806-870 MHz



Trunked Radio Systems

Central Controller

Feature	Description	Benefits
Advanced Microprocessor Technology	All of the logic to perform functions and operations of the trunking system are contained on plug in cards within the unit. These cards contain programmable microprocessors capable of: • Systematic processing of requests for channels. • Automatic channel assignment. • Fleet/subfleet organization.	Advanced microprocessor technology brings the ultimate capability in logic and control techniques to the two-way radio market. The Central Controller's modular design allows you to update or change your system's organization easily and economically.
Orderly System Expansion Capability	A Motorola trunked system can be initially configured to operate on less than 20 channels and later be increased to the full 20 channel capacity. Expansion is accomplished through factory software changes and the addition of plug-in modules.	Orderly system growth is accommodated easily and economically. When the need arises to expand your system, it can be done without making any changes to the existing mobile fleet.
Reliable Signaling Technique	A patented signaling technique is employed which helps reduce interference resulting from noise, standing waves and contention.	This extremely reliable signaling technique uses error detection and correction methods to enhance dependable operation in Motorola designed radio systems.
Signaling Flexibility	Signaling data words are designed for maximum flexibility. Different fleet and subfleet segmentation can easily be accommodated.	Signaling flexibility allows the addition of future options without major system modifications.
Dedicated Control Channel	A dedicated control channel is employed for continuous communications between mobiles and the Central Controller. In the event that a failure occurs on the current control channel, one of the voice channels will be reassigned as the control channel.	Use of a dedicated control channel allows the Central Controller to continue processing calls, even if all voice channels are busy. Calls are placed in a queue and assigned a channel on a First-in First-out basis.
Automatic Queuing and Call Back	If all channels are temporarily busy, incoming calls are placed in an ordered line or queue. As soon as a channel is available, the mobile operator is alerted by a short audible tone and communications can begin.	This unique Motorola feature eliminates the need for monitoring or constantly retrying for an available channel.
Recent User Priority	This feature gives callers who have just completed a call priority over other call requests.	Recent user priority feature greatly enhances communications continuity.
Failsoft Protection	In the event of a Central Controller failure, groups of users revert to preassigned continuously keyed repeaters.	Failsoft protection allows communications to continue despite the condition of the Central Controller.
System Dependability	The Central Controller has built-in diagnostic capability. Should certain failures in the system occur, they will be detected automatically by the Central Controller.	Failures such as a malfunction of a repeater channel are automatically diagnosed and reported to allow corrective action to be taken quickly. Because potential system problems are identified early, down time is dramatically reduced. In many instances, system users are unaffected by such occurences.
Continuous Assignment Updating	The Central Controller will continue to make channel assignment updates to mobiles for as long as the fleet uses the same channel.	Mobiles that have just come into service or re-enter from an out-of-range spot will automatically receive all fleet transmissions, if any are in process.

Feature	Description	Benefits
Options		
Back-up Central Controller Boards	A spare set of boards can be factory shipped with the Central Controller. These boards provide total redundancy for all control circuitry.	In case of a failure in one of the active boards, the corresponding back-up board can be manually put into service. The system can be restored quickly while the failed board is being repaired.
System Manager Terminal	This keyboard and printer terminal provides equipment status and alarm reporting, as well as individual channel control. In addition, the System Manager Terminal allows access to the Central Controller's Negative Subscriber List and time out parameter features.	Provides the system manager with direct interface and control to the Central Controller. Accessing the Negative Subscriber list allows the system manager to remove up to 16 fleets from active service.

35/70/125 Watt Trunked Repeaters

Feature	Description	Benefits
Advanced Base Station Design	Advanced in every sense of the word, these stations feature: • Top performance transmitter, rated for continuous duty • Variable power output from 17-35 watts, 35-70 watts, and 60-125 watts • Advances mechanical design with unified circuit chassis, built in RF shield and filtering standard on all stations.	Designed for high quality, reliable performance, these stations are built with state-of-the-art technology and the highest reliability semiconductor devices. Easily accessible printed circuit board assemblies and plug-in modules enhance fast, easy maintenance testing and repair.
100% Solid State (35/70 Watt Repeaters Only)	100% solid state transmitter, receiver and power supply means greater reliability and efficiency.	These solid state base stations provide you with instant full rated transmit and receive power. Designed for cooler operation, 800 MHz Trunked stations offer longer component life with minimal maintenance.
System Compatibility	Trunked MICOR repeaters contain all the circuitry necessary to interface to the Central Controller. All repeaters are identical and can be used for voice or the dedicated control channel.	Since all repeaters are identical, system expansion is accomplished easily. Systems can be initially designed for five channel operation and be expanded as needed to up to 20 channel operation.
Cabinet Durability	Stations are available in compact cabinets that are rugged yet attractive enough for almost any environment.	Vinyl covered cabinets are not subject to chipping or scratching. Vinyl covering also protects cabinets against rust and the elements.
Maintenance Feature	Plug-in modules, standard 19″ rack mounting and metering sockets are standard on all stations.	Maintenance checks and servicing are completed quickly and easily. Plug-in modules and standard size rack mounting allow for easy removal and replacement of parts, if necessary.
Factory Pre-Test	All stations are factory tested under normal operating conditions prior to shipping.	Factory pre-testing helps eliminate problems which might otherwise occur during initial operations.

Trunked Radio Systems

System Central Controller
General Specifications

Model Number:	T1958
Cabinet Size:	60″ H x 22″ W x 19¼″ D (1524 x 559 x 489 mm)
Power Requirements:	Input voltage 97-145V ac Current: 12 amp 50-60 Hz
Temperature Range:	−30°C to +60°C (−22°F to +142°F)
Base Repeater Interface:	The system repeaters are connected to the System Central Controller via a 12 conductor cable provided with each repeater. The maximum allowable cable length is 100′.
Peripheral:	RS232 interfaces are provided for optional peripheral devices.

Trunked Repeaters
General Specifications

Models:	C45RCB 5103-T C65RCB 5103-T C75RCB 6105-TSP801
No. of Frequencies:	Single frequency stations
AC Power Input:	120V, 60 Hz, single phase (3-lead grounding-type cable supplied).
AC Current Drain: (at 121V, 60 Hz)	35W model—Standby: .85A Transmit: 5.0A 70W model—Standby: .85A Transmit: 6.1A 125W model—Standby: 2.6A Transmit 7.6A
Metering:	125W: 2 panel mounted meters provide indication of power amplifier voltage & current essential for tuning & checking (standard). Optional internal-mounted meter used to measure receiver and transmitter circuits essential for tuning and checking.
Shipping Weight:	35W: 143 lb. (64 kg); 70W: 157 lb. (71 kg) 125W: 300 lb. (136 kg)

Transmitter

Frequency:	851-866 MHz
RF Power Output:	17-35W; 35-70W, 60-125W variable
Output Impedance:	50 ohms
Frequency Stability:	±.0001% from −30°C to +60°C ambient (+25°C Ref.)
Modulation:	15F2, 16F3 & 16F9: ±5 kHz for 100% @ 1000 Hz.
Audio Sensitivity Local Control:	0.12V ±3 dB for 60% max. deviation @ 1000 Hz
Antenna Connectors:	Xmtr—Type "N" Rcvr—Type "BNC"
Conducted Spurious & Harmonic Emissions:	−85 dB
FM Noise:	55 dB below 60% system deviation @ 1000 Hz
Audio Response:	+1, −3 dB from 6 dB/octave pre-emphasis 300-3000 Hz reference to 1000 Hz.
Audio Distortion:	Less than 2% @ 1000 Hz; 60% system deviation
FCC Designation:	35W: ABZ89FC5603 70W: ABZ89FC5604 125W: CC5011 Licensable under FCC rules Part 90 for 15F2, 16F3 and 16F9 emissions.

Receiver

Frequency:	806-821 MHz
Channel Spacing:	25 kHz
EIA Modulation Acceptance:	±8 kHz minimum
Selectivity— EIA SINAD:	−80 dB
Frequency Stability:	±.0002% from −30°C to +60°C ambient (+25°C ref.)
Sensitivity— 20 dB quieting:	Less than 0.5 μV
EIA SINAD:	Less than 0.35 μV
Intermodulation— EIA SINAD:	−75 dB
Spurious & Image Rejection:	100 dB
Audio Characteristics— Remote Control Models:	*For Local Speaker:* Output Available: 5 watts at 8 ohms Response: +2, −8 dB Distortion: 5% at 1000 Hz Hum & Noise: −50 dB
RF Input Impedance:	Nominal 50 ohms
FCC Rcvr. Cert. Number:	RC0135

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Specifications subject to change without notice.

MOTOROLA

HELIAX
Transmission Line

- *Low-Loss LDF Foam HELIAX for Economy*
- *Air HELIAX for Maximum Efficiency*
- *Polyethylene Jacketed for Increased Service Life*
- *High Flexibility and Crush Resistance Characteristics*
- *Maximum Corrosion Resistance*
- *Weatherproof Construction*

½″ LDF Foam HELIAX Coaxial Cable

⅞″ LDF Foam HELIAX Coaxial Cable

⅞″ Air HELIAX Coaxial Cable

Features ● Benefits

Low Signal Loss—The foam polyethylene used in LDF HELIAX is of a new low-loss design. ● These cables have loss characteristics approaching those of air dielectric cables. Both air and foam cables incorporate high-conductivity copper or copper-clad inner conductors, and copper outer conductors.

Weatherproof — ● The outer and inner conductors are constructed with copper for optimum resistance to the deteriorating effects of humidity, salt air, rain, snow and corrosive atmospheres. Tough polyethylene jacketing material prevents galvanic corrosion caused by contact between dissimilar metals, and reduces interference caused by the rectifying action of oxides. Black pigment throughout the jacketing assures maximum resistance to the sun's ultraviolet rays. The LDF foam cables have an annularly corrugated outer conductor which prevents any longitudinal moisture path. Connectors for both air cables and LDF foam cables employ "O" ring seals which prevent moisture entry.

Simplified Installation—Combining excellent crush resistance with flexibility, the outer corrugated tube on all HELIAX transmission lines lends itself to easy bending on a short radius for simplified, versatile installations. ● Connectors may be assembled with standard hand tools. The LDF foam cable connectors utilize a unique self-flaring feature which provides positive electrical contact.

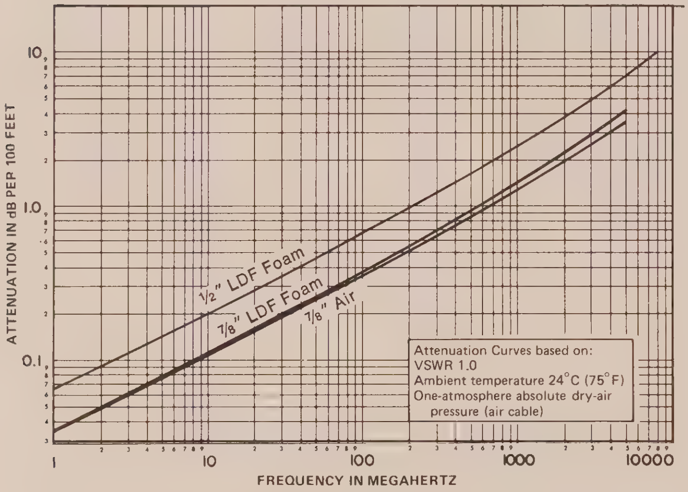
The LDF Foam HELIAX Transmission Line is supplied in two sizes, ½″ and ⅞″ and the Air HELIAX Transmission Line is available in the ⅞″ size. All ⅞″ transmission line kits are supplied with a 6-foot, ½″ LDF Foam HELIAX jumper cable for connection to the antenna. All transmission line kits are supplied with an 8-foot jumper cable for connection to the base station, and with jacketed tie wires for attachment to the tower. A hardware kit is included which consists of a mounting plate, a mounting bracket, rawlplugs, screws, nuts, lockwashers, tape and silicone grease.

HELIAX Transmission Line

Performance Specifications

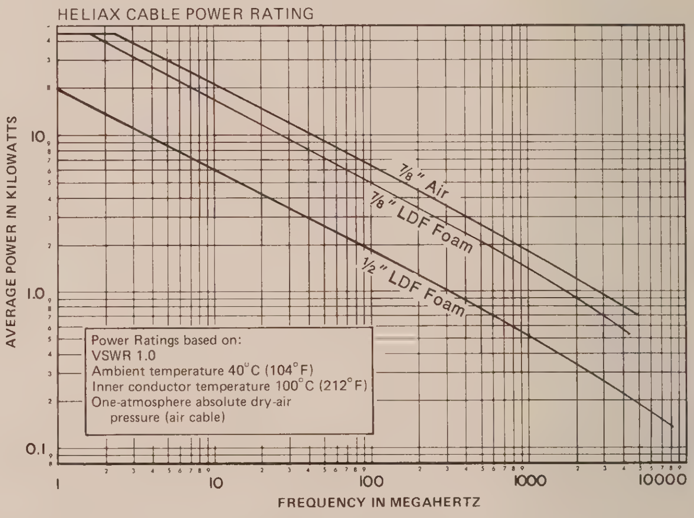
	½″ LDF Foam HELIAX		⅞″ LDF Foam HELIAX		⅞″ Air HELIAX	
Maximum Power Rating:	SEE GRAPH BELOW					
Impedance:	50 ohms		50 ohms		50 ohms	
Velocity of Propagation:	87.5%		89.5%		91.6%	
Attenuation, see graph below:	dB/100 ft.	dB/100 m	dB/100 ft.	dB/100 m	dB/100 ft.	dB/100 m
at 40 MHz	0.44	1.44	0.23	0.75	0.23	0.75
at 150 MHz	0.86	2.82	0.48	1.57	0.46	1.51
at 450 MHz	1.52	4.99	0.88	2.89	0.83	2.72
at 800 MHz	2.15	7.05	1.22	4.00	1.11	3.64
at 960 MHz	2.40	7.87	1.38	4.53	1.25	4.10
Minimum Bending Radius:	5 in. (127 mm)		10 in. (254 mm)		10 in. (254 mm)	
Weight Per 100 ft.	16 lbs. (7.3 kg)		33 lbs. (15 kg)		54 lbs. (24.5 kg)	
Weight Per 100 m	24 kg (53 lbs.)		49 kg (108 lbs.)		80 kg (176 lbs.)	
Outside Major Diameter (Over Jacket):	0.64 in. (16 mm)		1.1 in. (28.2 mm)		1.11 in. (28.3 mm)	

NOTE: Connectors are attached to line at factory unless otherwise specified. Standard tools can be used to complete the installation.



Attenuation Curves based on:
VSWR 1.0
Ambient temperature 24°C (75°F)
One-atmosphere absolute dry-air pressure (air cable)

Attenuation
For LDF Foam and Air HELIAX Cables



Power Ratings based on:
VSWR 1.0
Ambient temperature 40°C (104°F)
Inner conductor temperature 100°C (212°F)
One-atmosphere absolute dry-air pressure (air cable)

Average Power Ratings
For LDF Foam and Air HELIAX Cables

Model Chart

TDN6815 ½″ LDF Foam only
TDN6816 ⅞″ LDF Foam only

Model Number		Cable Termination at Base Station	Cable Termination at Antenna
TDN6596	½″ LDF Foam	UHF Male	UHF Female
TDN6597	½″ LDF Foam	UHF Male	N Male
TDN6598	½″ LDF Foam	UHF Male	N Female
TDN6599	½″ LDF Foam	N Male	N Male
TDN6608	½″ LDF Foam	N Male	UHF Male
TDN6600	⅞″ LDF Foam	UHF Male	UHF Male
TDN6601	⅞″ LDF Foam	UHF Male	N Male

Model Number		Cable Termination at Base Station	Cable Termination at Antenna
TDN6602	⅞″ LDF Foam	N Male	N Male
TDN6603	⅞″ LDF Foam	UHF Male	N Female
TDN6609	⅞″ LDF Foam	N Male	UHF Male
TDN6604	⅞″ Air	UHF Male	N Male
TDN6605	⅞″ Air	N Male	N Male
TDN6606	⅞″ Air	UHF Male	UHF Male

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Communications and Electronics Inc.

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1301 East Algonquin Rd., Schaumburg, Illinois 60196
(312) 397-1000

April 12, 1982

Memo to: Area F Sales and Service Personnel
From: Western FTR District
Subject: 800 MHz Trunking Gain Antennas

It has become apparent recently that many salespeople are selling 800 MHz Trunking systems with 3dB gain mobile antennas. Most all Trunking mobile licenses are granted for 35 watts E.R.P.

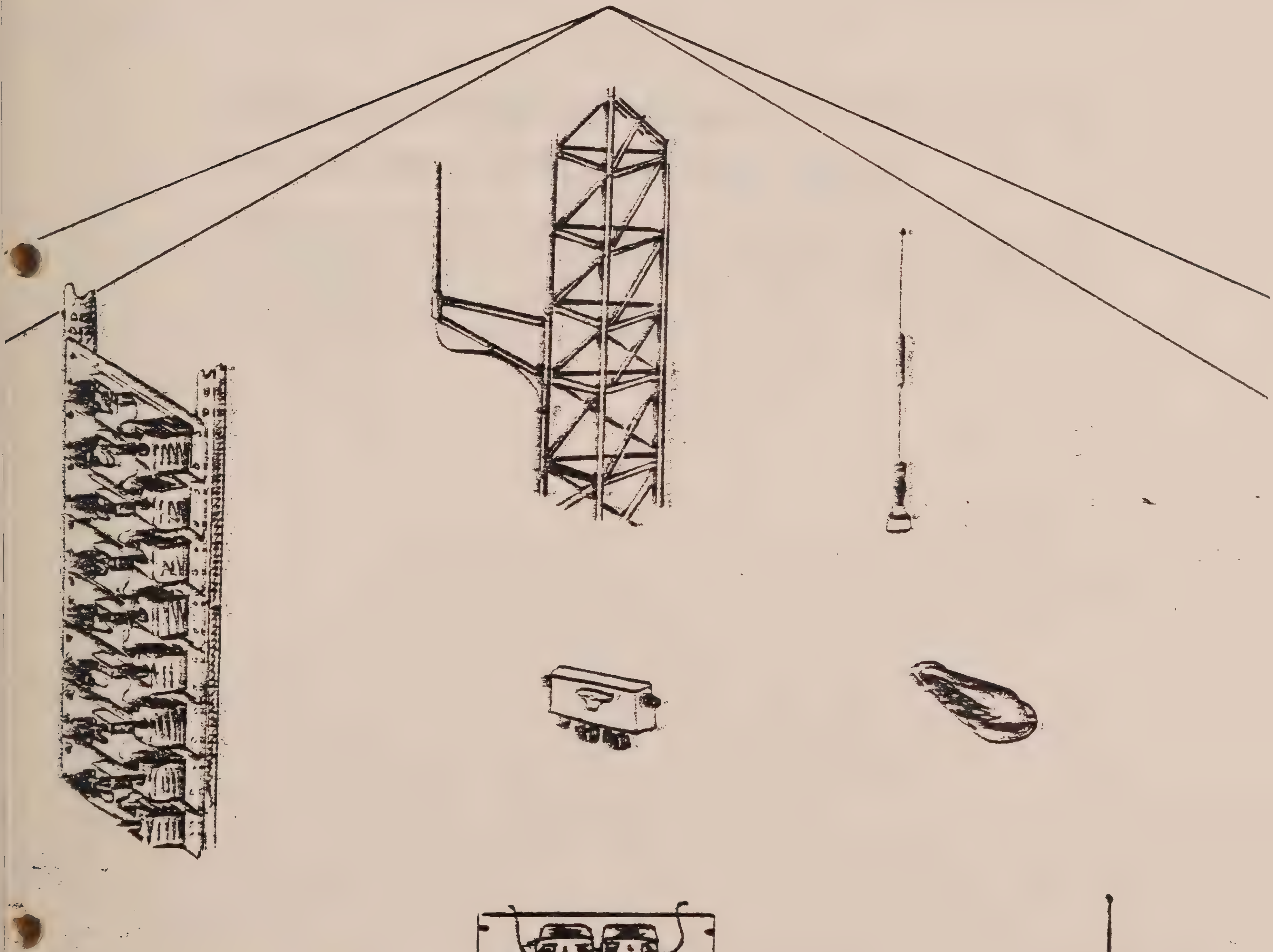
This means that a 35 watt Syntor cannot legally use a gain antenna, since it is already 35 watts E.R.P. with its quarter wave 'spike'.

A Motrar, on the other hand, is a 10 watt radio and will be 20 watts E.R.P. with use of a 3dB gain antenna.

Due to the characteristics of 800 MHz, 'gain' is mostly realized at the horizon, as on flat land, and little or no mobile improvement will be noticed in mountainous areas.

FOR

800 MHz SYSTEMS

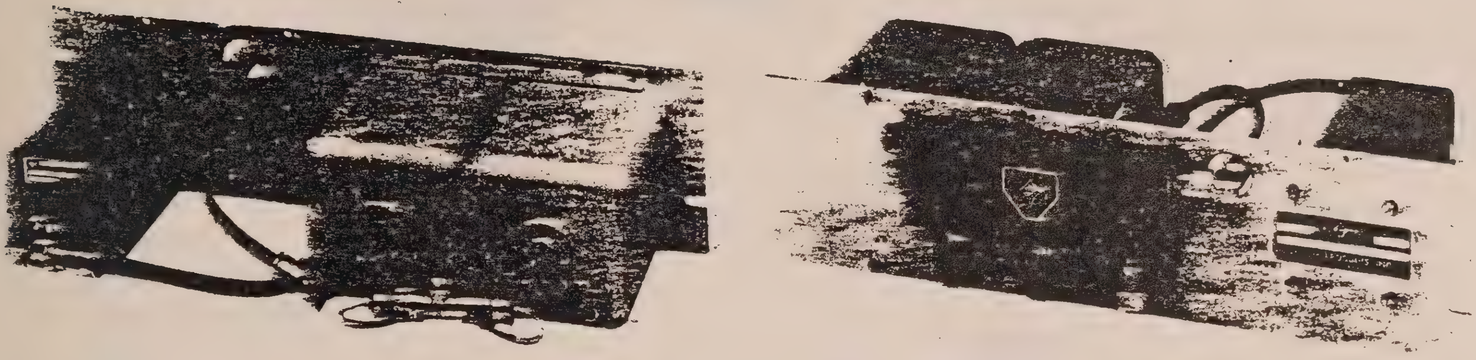


WHATEVER YOUR ANTENNA SYSTEM NEEDS IN THE 800 MHz BAND, DECIBEL HAS IT.

PRICES SHOWN ARE USER PRICES, F.O.B. DALLAS, TEXAS AND DO NOT INCLUDE ANY TAXES, EXPORT PACKING, INSURANCE, DOCUMENTS, TARIFFS OR DUTIES. ALL PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE. COMPLETE INFORMATION CONCERNING WARRANTY, TERMS, AND CONDITIONS OF SALE APPEAR INSIDE THE BACK COVER OF THE DECIBEL CATALOG.

800 MHZ DUPLEXER AND ISOPLEXER

DB4402



800—946 MHz ISOPLEXER

USING DB-4090 DUPLEXER
AND DB-4347 ISOLATOR

PRICE $920.00

	DB-4090	**DB-4402**
Insertion Loss:	.7dB	1.6dB
Power Handling:	150w	150w
I. M. Isolation:	——	65dB
Temperature Range:	—30° C to 60°C	
Receiver Isolation:	70dB	70dB
Tx Noise Suppression:	70dB	70dB
Frequency Separation:	45 MHz	45 MHz
Tx to Receiver Isolation:	50dB	60dB

DB4090

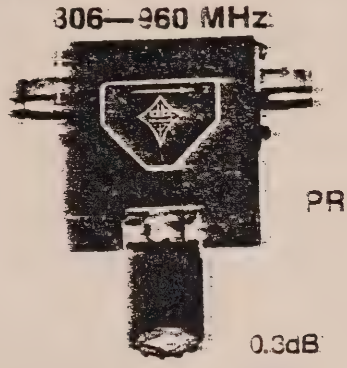
800—946 MHz DUPLEXER

PRICE $290.00

800 MHZ ISOLATORS, HYBRID COUPLERS, Z-MATCHER, HARMONIC FILTER, AND LOADS.

ISOLATOR (Single-Broadband, 25 Watt Load supplied)

306—960 MHz



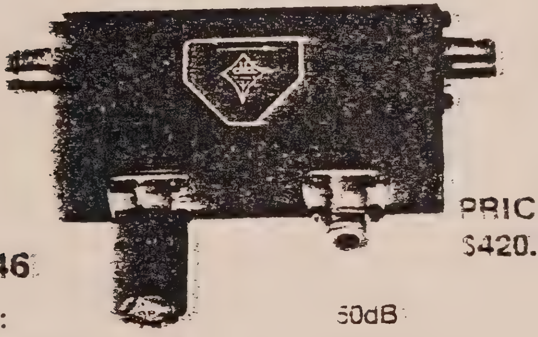
PRICE $250.00

DB4348

Isolation:	0.3dB
Insertion Loss:	30dB
Max. Power Input:	150w
Max. Reflect Power:	25w

ISOLATOR (Dual-Broadband, One 25 Watt Load supplied)

306—960 MHz



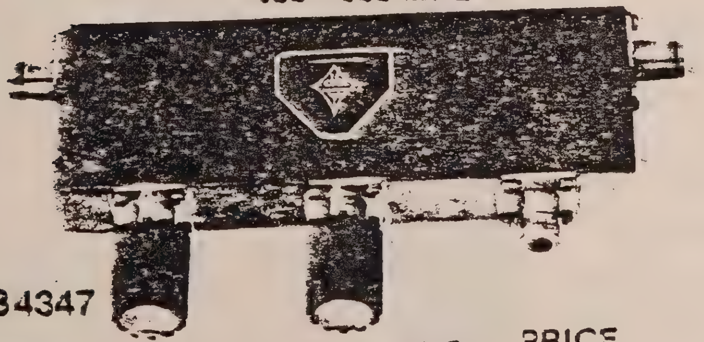
PRICE $420.00

DB4346

Isolation:	50dB
Insertion Loss:	.6dB
Max. Power Input:	150w
Max. Reflect Power:	*

ISOLATOR (Triple-Broadband Two 25 Watt Loads supplied)

306—960 MHz

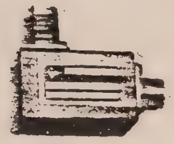


DB4347

Isolation:	65dB
Insertion Loss:	.85dB
Max. Power Input:	150w
Max. Reflect Power:	*

PRICE $560.00

**Depends pwr rating of load used on third load port*



PRICE $60.00

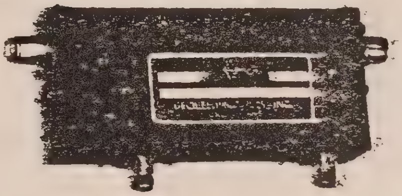
DB4340
Z-MATCHER 800—870 MHz

Max. Power Input: 300 watts
UHF or N type Connectors

PRICE $80.00

DB4333
HARMONIC FILTER 806—960 MHz

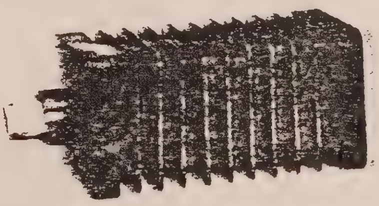
Attenuation (2nd & 3rd Harmonic): 60dB
Max. Power Input: 300 watts.



PRICE $240.00

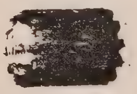
DB4309
HYBRID COUPLER
806—870 MHz or 870—960 MHz

Insertion Loss: 3.2dB
Isolation: 40dB



PRICE $140.00

DB4303
100 WATT LOAD

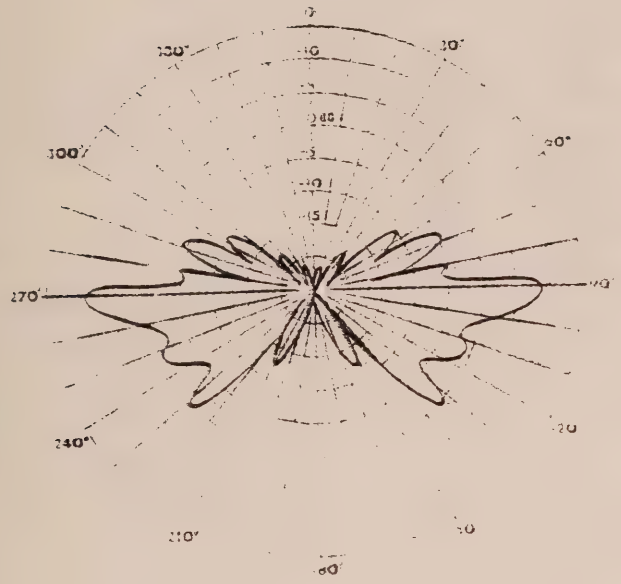


LOAD
25 WATT

PRICE $25.00

DB4301

800 MHZ BASE/REPEATER



DB480

806—870 MHz
BROAD BAND ANTENNA

Gain: 7.5dB

B.W.: 64MHz

Power Input: 500 Watts

Length: 96½ Inch

Diameter: 3½ Inch

PRICE $524.00

800 MHZ CONTROL STATION ANTENNA

DB495

806—949 MHz
CORNER REFLECTOR — DIRECTIONAL ANTENNA

Gain: 9.0 dB

B.W.: 64 MHz

Maximum Power Input: 150 Watts

Front to Back ratio: 25 dB

PRICE $124.00

800 MHZ MOBILE ANTENNA

DB725

806—870 MHz

3dB Gain over ¼

64 MHz Bandwidth
Power: 125 Watts
Overall Length is 16 Inches above mounting surface.

PRICE $36.50

NOTE:

ALL THREE MODELS UTILIZE 15 FOOT AA3096 LOW LOSS CABLE WITH EITHER N MALE OR UHF CONNECTORS. ¼ INCH SUPERFLEX HELIAX IS AVAILABLE AS AN OPTION.

DB727

¼ Whip

806—870 MHz

Bandwidth: 70 MHz
Power: 125 Watts
Comes with Standard Low Loss Cable and UHF or N Connector

PRICE $17.00

DB726

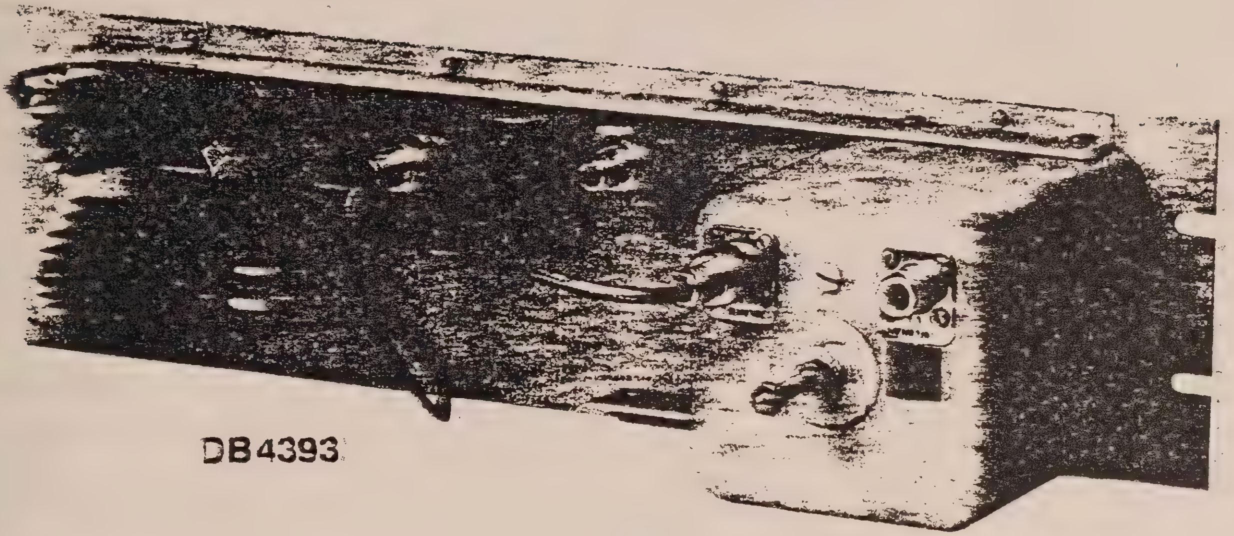
806—870 MHz

Special Purpose Antenna

Approaches Unit Gain with respect to a ¼
Power: 100 Watts
Dimension: (HxL) 1.5"x10"

PRICE $37.50

800 MHZ ISOFILTERS



DB4393

PRICE $785.00

PANEL-A-CHANNEL TRANSMITTER COMBINER

DB4406

PRICE $910.00

DB4393, DB4394, DB4406
ISOFILTER
SPECIFICATIONS

ELECTRICAL

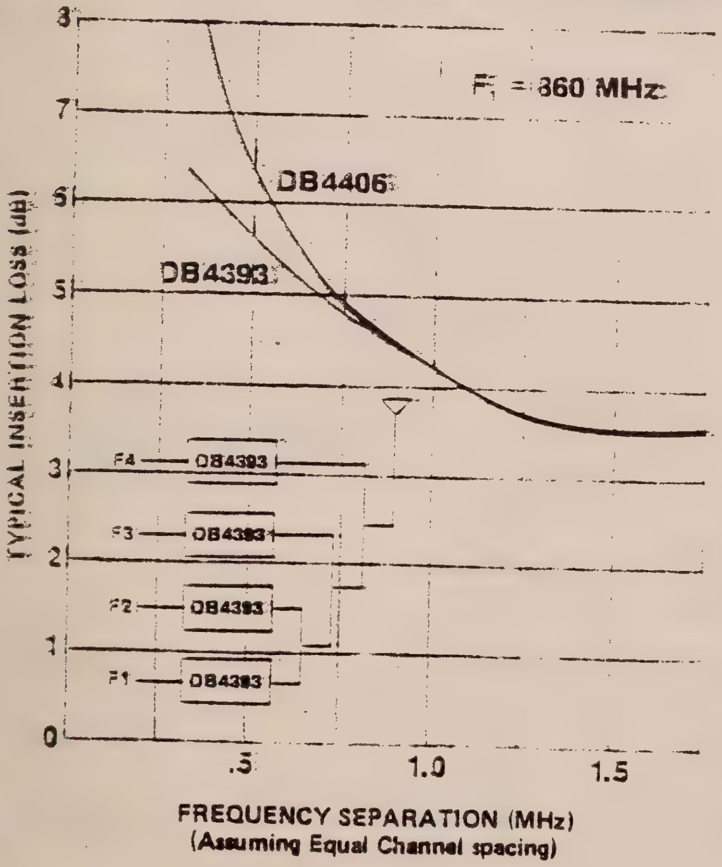
	DB4393, DB4406	DB4394
Frequency Range	851-370MHz	851-370MHz
Frequency Spacing (min)	500 KC	500 KC
Isolation (min)		
Tx-Tx	65dB	60dB
Antenna — Tx	60dB	55dB
Insertion Loss	See Fig. 1	same as DB4393 less .25dB
Attn: Harmonics and Intermod. Products (min)	65dB	65dB
Temperature Range	-30° C + 0 + 60° C	
Max. Input VSWR	1.25 to 1	
Max. Power Input	150 w	

MECHANICAL

Dimensions (H x W x D)	5-1/4" x 19" x 8-1/4"
Mounting	19" Rack
Connector Terminations	N Female
Finish	Beige Vinyl Enamel

NOTE: DB4406 Has Better Tx. Noise Attenuation Than The DB4393.

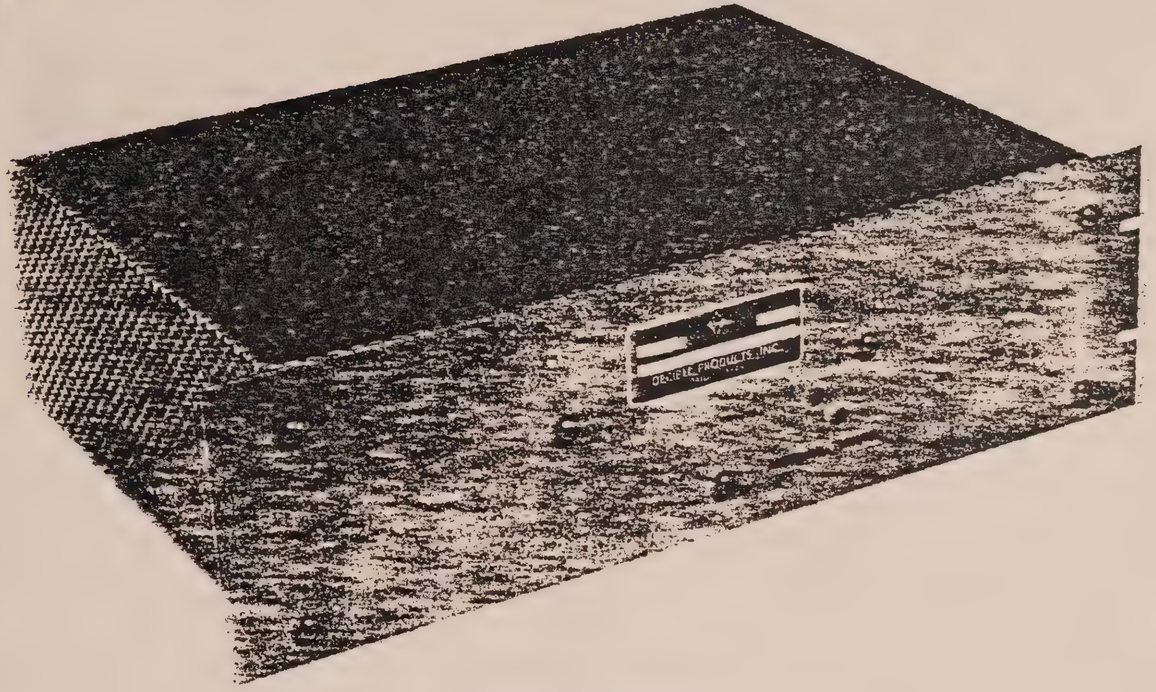
TRANSMITTER COMBINING APPLICATIONS



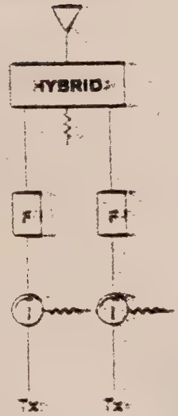
10 CHANNEL — TRUNK
SYSTEM TX. COMBINER
(Utilizing DB4394 and DB4406 Isofilter)

800 MHZ HYBRID TRANSMITTER COMBINER

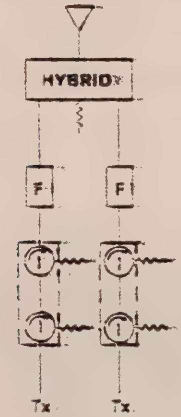
806—960 MHz



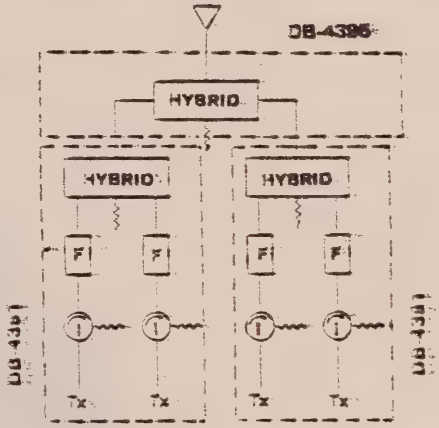
TRANSMITTER COMBINERS



Two-transmitter combiner with hybrid, harmonic filters(F) and isolators(I) as supplied in Model DB-4391 Two Tx combiner.



Two-transmitter combiner with hybrid, harmonic filters(F) and dual isolators (I) as supplied in Model 4392 Two Tx combiner.

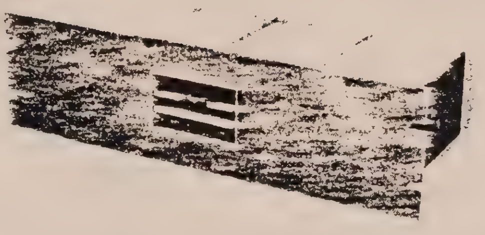


Four-transmitter combiner showing use of the DB-4395 hybrid coupling panel to combine outputs of two dual-Tx combiners.

	Insertion loss (dB) max.)	Isolation (dB) Tx to Tx Antenna to Tx	Power handling (watts)	PRICE
DB4391	4.2 dB	70 dB 28 dB	150 Watts	$1,130.00
DB4392	4.7 dB	100 dB 53 dB	150 Watts	$1,690.00
DB4395	3.2 dB	40 dB 3.2 dB	100 Watts	$ 440.00

800 MHZ RECEIVER MULTICOUPLING

"SHAPE FACTOR" PRESELECTORS



DB4180 (Shape Factor Filter)

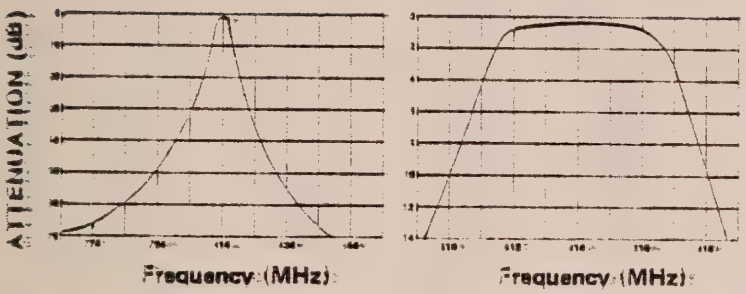
PRESELECTOR

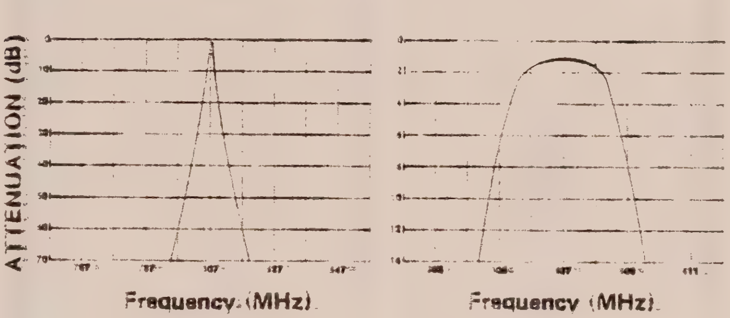
PRICE $449.00

DB4181 (Shape Factor Filter)

PRESELECTOR

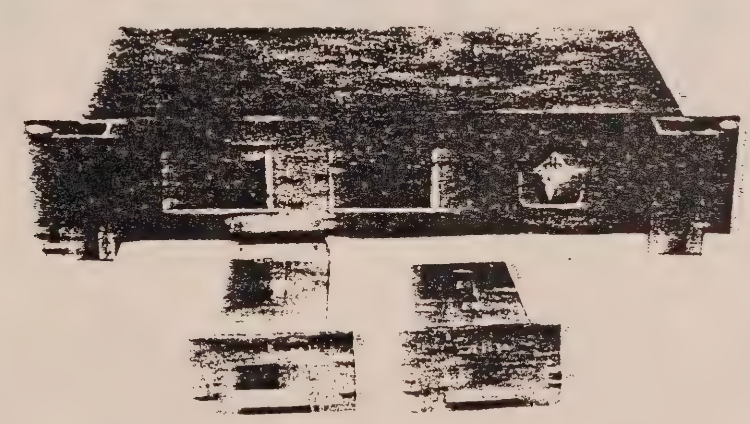
PRICE $535.00





NOTE: OTHER SPECIAL APPLICATION SHAPE FACTOR FILTERS AVAILABLE

MODULAR RECEIVER MULTICOUPLER



806—850 MHz

Four (expandable to 32 Channels)

Noise Figure: 3.5 dB

Third Order Intercept Point: 36dB minimum

Power Requirements 115 VAC. (60 Hz)

DB8504—000

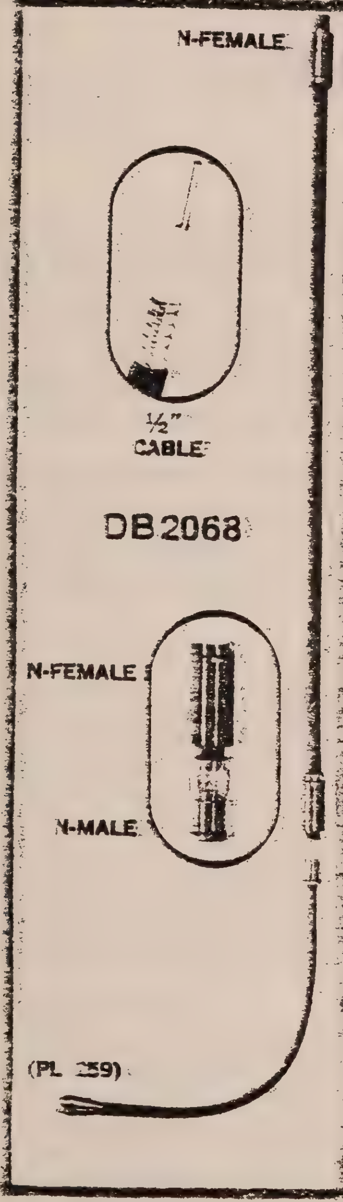
RECEIVER MULTICOUPLER

With high performance amplifier module

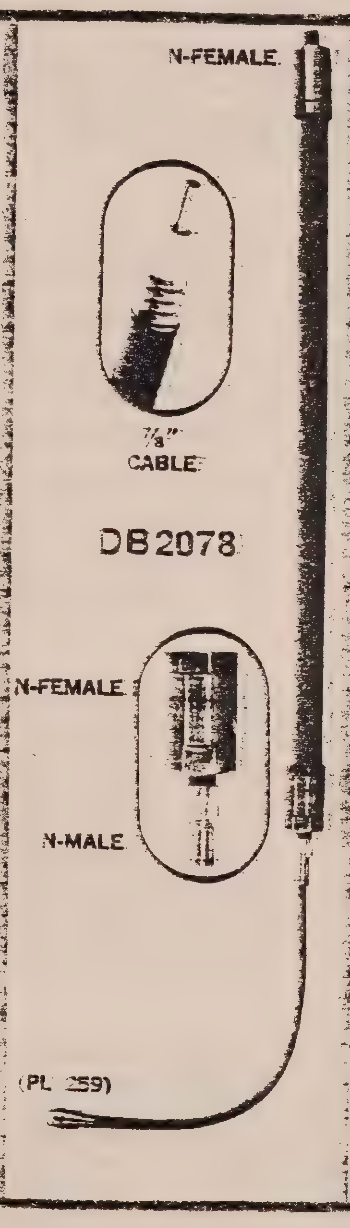
PRICE $890.00

LOW DENSITY FOAM HELIAX FOR 800 MHZ

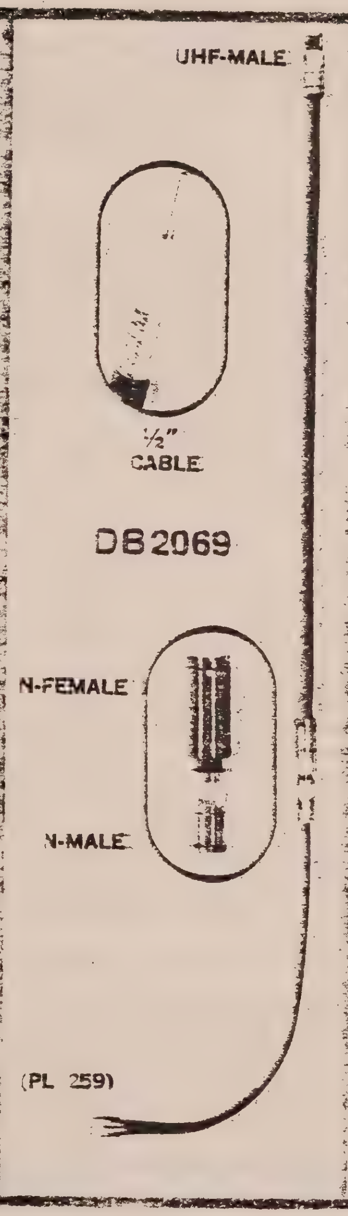
PRICE
$36.00
+ 1.12/FT.



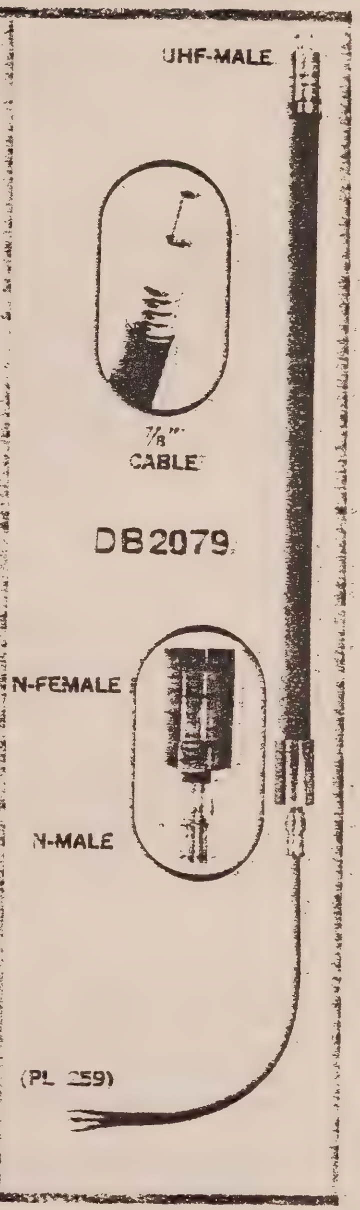
PRICE
$72.00
+ 2.95/FT.



PRICE
$36.00
+ 1.12/FT.



PRICE
$72.00
+ 2.94/FT.



	DESCRIPTION	TOP CONNECTOR	ATTEN db/100 Ft.	PWR RATing (Ave.)
DB-2068	– LDF4 – 50 1/2" Foam HELIAX Jacketed w/Pigtail	N Female	2.4	600W
DB-2069	– LDF4 – 50 1/2" Foam HELIAX Jacketed w/Pigtail	UHF Male	2.4	600W
DB-2078	– LDF5 – 50 7/8" Foam HELIAX Jacketed w/Pigtail	N Female	1.37	1500W
DB-2079	– LDF5 – 50 7/8" Foam HELIAX Jacketed w/Pigtail	UHF Male	1.37	1500W

→ Dick Coleman

FYI –

4-15-82

Decibel
Products,
Inc.

MATTERS OF FACT

QUARTERLY NEWSLETTER MARCH 1982 VOL. 2, NO. 1

800MHz TRUNKED SYSTEMS INTERFERENCE

As more and more 800MHz Trunked Systems are put into service, some operators have started to notice interference problems in single antenna systems. The symptoms of which have extended from poor system coverage to busy channels.

The existence and severity of the interference problems are reported to vary from radio equipment supplier to supplier. Some, in fact, are reported to have no problem at all.

THE INTERFERENCE PROBLEM:

The sources of the reported interference take the form of intermodulation①. This intermodulation is reported to be the mixing of transmitter carriers of the Trunked System producing IM carriers on frequency with one or more receivers in the same system. The result is receiver degradation and distortion causing reduced system performance. There seem to be two reported sources of this IM interference in 800MHz Trunked Systems. One is related to "close-in" mobile operation where strong mobile transmitter carriers are present in the Trunked Receiver Antenna System. The other is related to a high order IM reported to be a mixing of base transmitters.

MOBILE RELATED IM:

Due to the equal 1MHz spacing between mobile transmitters and between base receivers, IM is mathematically predictable. Because of the high IM conversion loss and low power levels from distant mobile transmitters, the generated IM signal is usually well below the receiver sensitivity and therefore not noticed by the receivers.

When mobiles are working geographically close to the base repeater site, their power levels in the base receiver system may become high enough that the generated IM becomes noticeable with consequential receiver system degradation.

This particular problem is minimized by adding isolation obtained through horizontal and vertical separation between the Base Trunked Receiver System and the mobiles themselves. In this way, mobile signal power levels are kept low enough to reduce, if not eliminate, this IM interference problem.

BASE STATION TRANSMITTER IM:

This type of IM is a more complex form of interference than the "close-in" mobile IM as previously discussed. It is reported as being generated when two or more Trunked Base Transmitters mix to produce signals on, or very near, one or more of the Trunked Receivers. Little is known about this type of IM or why it occurs with the 45MHz separation between the base transmitters and receivers. However, the IM generated appears to be in the area of the 29th or 31st order. With such high orders of IM, the generation is most likely to occur in a broadband nonlinear junction. These nonlinear junctions act as diodes and create a mixing point for strong RF signals. Some of the common causes of these nonlinear junctions are:

1. Rusty tower connections
2. Loose Connectors
3. Non-compatible metal junctions
4. Moisture in connections
5. Ferromagnetic materials in connectors.

The sources of this IM interference, as reported are not limited to any specific component in an Antenna System. Further, the IM interference may be intermittent and no doubt difficult to identify or locate. In fact, interference problems of this sort may not even occur at all until the system has been installed (aged) for some time. Since the reported source areas of this type of IM are hard to identify and correct, and since this interference occurs most often in single antennas systems, many equipment suppliers are recommending dual antenna systems in 800MHz Trunked Systems.

THE DECIBEL ALTERNATIVES:

In our opinion, the best arrangement for a Trunked System is to use separate antennas. This means that the Transmitter Combiner will work into a separate single Transmission Line and Antenna, while the Receiver Multicoupler will have its own Transmission Line and Antenna. Isolation between the two antenna systems should be at least 30dB.

Going to two separate 6dB (ie, DB-806) or 9dB (ie, DB-809) antennas provides minimum system interference caused by base transmitter IM.

The Decibel Model DB 806D Antenna provides two separate 6dB antennas in a single radome (8 feet long), with two inputs. The antennas are vertically spaced inside the radome with 40dB isolation between them. Using the DB 806D eliminates the need for two mounting positions and cuts site rental in many cases.

Another approach, which is more economical than the two antenna system, is to use the DB-806DX② Antenna. This antenna is in reality an Antenna System consisting of two separate antennas that are isolated in a single radome and then combined into a common input feed.

If you have been experiencing interference problems in a single

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① — See "About Combiners" Decibel Products

② — Patent Pending

Decibel
Products,
Inc.
P.O. Box 47128
Dallas, TX 75247
214/631-0310

antenna system, one of these three approaches may be a solution. GIVE US A CALL

THE DECIBEL ANTENNA SYSTEM:

Decibel Products, the foremost leader in antenna systems, offers more to our 800MHz Trunked System customers in Total Antenna Systems. We supply quality broadband base and mobile antennas, a full line of transmission line and interconnect cables, and the best performing TX combiners and receiver multicouplers in the industry. We top this with Know-How in Systems Engineering support.

Decibel's engineers have worked and dealt with 800MHz Antenna Systems since their introduction and can design a 800MHz Trunk Antenna System tailored to your need.

A few of the products being offered are:

DECIBEL 800MHz ANTENNAS:

1. DB806 is a 6dD gain 800-900MHz broadband antenna that is only four feet long.
2. DB806-D is a dual 6dB gain 800-900MHz broadband antenna in a single radome housing with two inputs. It is only eight feet long and provides 40dB isolation between antennas.
3. DB806 DX is a dual 6dB gain 800-900MHz broadband antenna in a single radome. Both antennas are combined into one feed input. This antenna is really an antenna system providing the advantage of dual antennas but only requiring a single transmission line.
4. DB809 is a 9dB gain broadband 800-900MHz antenna. It has a broader bandwidth and smaller size when compared to competitive models.
5. DB495 is a directional antenna providing 64MHz bandwidth and 9dBd forward gain.

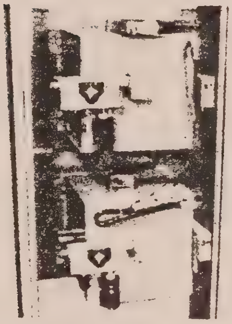
TRANSMISSION LINE:

Decibel offers HELIAX®: LDF, Superflex, Air Line and a complete line of accessories which include connectors, clamps, tie wires, and interconnect cables.

COMBINERS:

The Decibel DB4458 is a low loss 5 channel cube Tx combiner. It has only 3dB Insertion Loss per channel when expanded to ten channels. It is easily tuned and the most competitively priced Tx combiner in the industry. The Decibel DB8508-101 is a high gain, 8 channel, low noise receiver multicoupler. It has "plug in" modules and occupies only 3.5" of rack space.

DB 4458 5-Channel Trunked Combiner $3920.00



DB 8508-101 Modular Receiver Multicoupler $1705.00

DB 8030 .... $7300.00

5 CHANNEL TRUNKED CUBE FILTER COMBINER — INCLUDES POWER MONITOR AND 12 CHANNEL RECEIVER MULTICOUPLER

- Tx Insertion Loss 2.0dB
- Tx to Tx Isolation 70dB
- Rx Multicoupler system gain 4dB

DB 8030

DB 8030

In the very near future, Decibel will be offering new and innovating products for your use.

GIVE DECIBEL A CALL TODAY! We have the solution to your 800MHz Trunked Antenna System requirement.

Product Services Bulletin

June 28, 1982

PSD #500
APC-N/A
DEADLINE DATE: N/A

MEMO TO: Area Service Managers

CC: Area Field Technical Representative Managers
Motorola C & E Parts
NSO School

FROM: Milt Messick

SUBJECT: CURRENT DEPOT SERVICE PROGRAMS

Certain products, due to their complex nature, require special test equipment and testing procedures. For these reasons, Motorola Depot Service was established. The following products have established Depot Service for our customers use or warranty repairs.

Product	Model #	Bulletin Info. and Depot Involved
Telco Terminals	T1821__ T1822__ T1823__	Motorola Midwest Service Depot 2227 Hammond Drive Schaumburg, Il 60195 312-576-5760
RCC Terminals	T1824__ T1825__ T1826__	
Trunking Controllers	T1921__ T1958__ T1970__ T1971__ T1972__ T3040__	SRN923, SRN935 Motorola Midwest Service Depot 2227 Hammond Drive Schaumburg, Il 60195 312-576-5760
Modax Terminals	XXXX (All)	Motorola Midwest Service Depot 2227 Hammond Drive Schaumburg, Il 60195 312-576-5760
SEE NOTE 6		
Paging Terminals	XXXX (All)	
DVP Code Inserters	T3010__ T3020__	SRN920 Motorola Midwest Service Depot 2227 Hammond Drive Schaumburg, Il 60195 312-576-5760
DVP Encode/Decode Modules	TRN6777__ PLN6022__	PSD428 Motorola Midwest Service Depot 2227 Hammond Drive Schaumburg, Il 60196 312-576-5760

Continued....

Product	Model #	Bulletin Info. and Depot Involved
Point-to-Point	XXXX (All)	MSB77 Motorola Microwave Module Serv. Center 2130 N. Palmer Dr. Schaumburg, Il 60195 312-576-5591
Energy Systems Controllers	Q2476__ Q2463__ Q2557__ Q2572__	Motorola Product Services 1301 E. Algonquin Rd. Schaumburg, Il 60196 312-576-6039
Digital Data Systems	IDS Microprocessor Products ("V" Model/Kit Numbers)	PSD498 Motorola Schaumburg Data Serv. Depot 2130 N. Palmer Dr. Schaumburg, Il 60195 312-576-5771
Alarm & Control Prod. (INTRAC)	XXXX (All)	Motorola Phoenix Data Repair Depot 1711 W. 17th Street Tempe, Az 85281 602-994-6472
Digital Data Systems (Note 5)	Centronics Printers	Manufacturers Warranty Serv. 800-258-1952
Pulsar VHF/UHF (Note 1)	XXXX (All) IF Filter Trisolector Power Amp FGU	SRN872A**, SRN893, PSD365, PSD435 PSD483, PSD464 Motorola Midwest Service Depot 2227 Hammond Dr. Schaumburg, Il 60195 312-576-5760
CCTV Package Model (Note 2)	V81021H	PSD494
Radio Pagers (Note 3)	XXXX (All)	3 & 5 Yr. Extended Performance Agreements and National Service Depot Maintenance.
Motorola Test Equipment (Note 4)	XXXX (All)	Motorola Test Equipment Repair 1313 E. Algonquin Rd. Schaumburg, Il 60196 312-576-7025 800-323-6967

Continued....

Use of these product depots is optional, but please note Motorola's Labor Warranty Policy and exceptions:

Example: The customer's Authorized Motorola Service Shop is called to the radio site only to find for example, the Trunking Controller "RIB" board is defective. The MSS has been told (via instruction manual) to "not repair" and send the board to our Motorola Trunking Depot for repair. The problem is payment to the local MSS for analyzation and mailing costs to the depot, during the Labor Warranty period.

To cover the above warranty situation, the Motorola Warranty Analyzation/Non-Repair policy is as follows:

> The depot-serviced products listed above with the exception of Pulsar VHF/UHF, CCTV Package, Radio Pagers, Test Equipment, Data Systems Centronics Printers, all other models, kits, parts not listed, have authorized the local Motorola Service Shop a maximum of one hour labor (plus travel where fixed equipment is involved) for non-repair analyzation time and handling of returns to the Motorola Depot during labor warranty period. Payment will be made using the Labor Warranty Claim Form (RO-21-19) when the defective main unit's model and serial numbers and actions taken are provided.

The Warranty Analyzation/Non-Repair Policy for the exceptions are as follows:

Note #1: Pulsar VHF/UHF units have several unique items such as FGU, Trisolector, Etc. The depot has been set up to repair, exchange or recondition these items as described in the bulletins. Units within the labor warranty period are to be treated as a normal warranty unit repair and are not subject to this bulletins one hour analyzation time.

Note #2: CCTV Package Model V81021H does not provide for local Motorola service analyzation or standard warranty repair time. Use PSD Bulletin 494 for warranty details.

Note #3: All radio pagers are not covered for this local Motorola service analyzation time. Contact the Service Department for details of the existing depot offerings.

Note #4: All Motorola test equipment is not covered for this local Motorola service analyzation time and all equipment must be returned to the Motorola Depot listed for warranty labor service.

Note #5: The Centronics Printers used with the Data Comm Systems Microprocessors are covered by the manufacturers warranty. An 800 number is to be used for their on-site service.

Note #6: Modax, plus Metro 10/100 will be serviced at the factory until 9/18/82 at which time Midwest will provide depot level service.

All models, kits and parts not listed in this bulletin are excluded.

SERVICE AND REPAIR NOTES
bulletin
MOTOROLA
COMMUNICATIONS AND ELECTRONICS, INC.
A SUBSIDIARY OF MOTOROLA, INC.
• 1301 E. ALGONQUIN RD. • SCHAUMBURG, ILL. 60196 •

ROUTING

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____
____

SRN-956
May, 1982
APC-243, 429
Deadline Date: N/A

VOICE BREAKTHROUGH ON TRUNKED SYSTEMS

MODELS AFFECTED: T1921A, T1958A, T1977A Central Controller

Recent reports have been received from Trunked Systems users experiencing voice breakthrough (users hearing other users). The purpose of this bulletin is to document the known reasons for such a phenomenon to occur.

1. Intermodulation (IM)

The majority of voice breakthroughs are the result of IM hits on the voice channel. The IM hit can be characterized as being heard by all members of the subfleet; distorted, over deviated, and heard upon dekey of the transmitting mobile. The sources of IM are well understood and can be addressed using conventional techniques. Operational sequence for IM detection follows.

During the message timeout period, 1 second, the repeater will unmute for a minimum of .5 second upon detection of any carrier. If a low speed connect tone is detected during the IM hit, the repeater will unmute for a minimum of 1.2 seconds. The presence of a valid connect tone in the IM signal is not unlikely since the tone is universally transmitted by all trunked mobiles.

The PARM's option gives the system owner the capability to reduce the timeout period and thus reduce exposure to IM. A reduction in the timeout period would make the system appear to be transmission trunked.

(OVER)

2. Failsoft:

When the central controller fails, all repeaters revert to a failsoft mode for operation. Mobiles on the system automatically revert to this mode on a pre-assigned voice channel. The mobiles are continuously unmuted and hear all transmissions during failsoft. Failsoft is characterized by a 900 Hz tone heard every 10 seconds. Mobiles in one fleet can communicate with mobiles in another fleet during this time.

Failsoft is an error condition that should rarely occur. If frequent failsoft operation is a current problem, review SRN-935, HOTLINE SETUP AND UPDATE INFORMATION FOR 800 MHz TRUNKED FIXED SYSTEM EQUIPMENT, to aid in resolving problems that cause failsoft.

3. Fringe Operation:

A user can drive out of range of the system and then return within range while remaining keyed. This could result in the transmitting mobile talking to the wrong group of mobiles if the central controller were to immediately reassign the voice channel to another group of mobiles. Upon release of PTT, the transmitting mobile would be sent back to the control channel due to a mismatch of the low speed connect word on the voice channel. All mobiles in the subfleet would hear distortion followed by an on-frequency signal that was the end of the transmission of the mobile that had originally driven out of range. The user would have to be out of range of the system for a minimum of 2.2 seconds while transmitting for this to happen, plus remain keyed longer than the mobile that was validly assigned the channel.

4. Multiple Mobile Carriers:

Fleets with undisciplined users can have multiple mobiles keyed on a voice channel. If the central controller can no longer recognize the connect tone due to the multiple carrier distortion, the channel will be assigned to another group of users similar to the fringe operation case.

5. Multiple System Access:

The minimum distance for channel re-use is 70 miles. Mobiles placed between two systems could access both of them. This problem is resolved through the use of SP connect tones on the voice channels. In addition to the SP tones, the control channels assignable by the central controller and scanned by the mobiles are limited from the standard four to two. If one mobile is accessing both systems, all mobiles with the same fleet/subfleet ID on the other system would hear one side of the conversation. The mobile transmit carrier would be on frequency and possibly noisy due to the fringe area operation. The mobile in the fringe area between the two systems could hear conversations from the other system if the fleet/subfleet ID matches. The use of SP tones

does not eliminate the problem of a mobile in the fringe area hearing the other system. However, it does prohibit this mobile from communicating with the wrong group of users. The SP tones provide protection for the path of mobile to base receiver. If a system requires SP tones, the salesman must be involved to order changes to the central hardware and software equipment.

6. Defective Tone Detector:

If a tone detector on a voice channel is intermittent in operation, the central controller may falsely disconnect the channel and reassign to another user. The effect would be the same as for the fringe operation case.

7. Roaming Mobile:

Each system has a unique ID transmit on the control channel once every 3 seconds. When a mobile is initially powered up, it will transmit and receive on any control channel it can find. If an improper ID is received, it will move off that channel and will search for another control channel. The mobile will not transmit or receive until the correct system ID is detected. If a user were to turn on the radio and immediately keyup, the unit may transmit on the wrong system. Once it went back to the control channel and received the system ID, it would be prohibited from further action.

This problem occurs when a mobile is driven out of the normal operating range of a system, and can only occur during the first 3 seconds after the radio is turned on or a new code plug is selected. In addition, this other system would have to have the same control channel frequencies assigned.

SUMMARY

IM is responsible for the majority of the occurrences of voice breakthrough. Use established techniques to investigate and resolve IM problems if they apply to your trunked system. If further assistance is required, contact your Motorola Salesperson or Area System Engineer.

This is a service aid bulletin. No charges will be accepted.

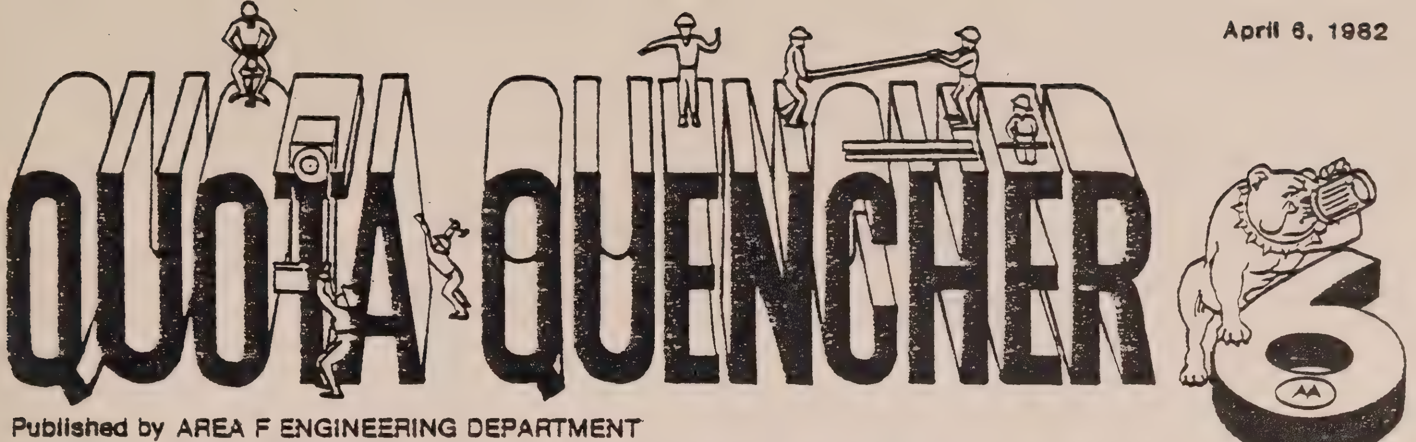
Manual

Syntor X Control Station	68P81043E55
Syntor X	68P81047E05
Syntor X2	68P81047E05
Motrar Logic	68P81112E18
Motrar RF	68P81112E18
Trunked Repeater	68P81031E45
Repeater RF	68P81031E45
Trunked Central Controller	68P81047E50
Trunked System Manager	68P81047E65

Positive Drive Screw Drivers

Small Tip	66-80344A57
Large Tip	66-80344A58

April 6, 1982



QUOTA QUENCHER

Published by AREA F ENGINEERING DEPARTMENT

Issue Editor: Pete Shroyer Chief Editor: Lee Threlkeld

DISPATCH EQUIPMENT FOR DUAL-SITE TRUNK RADIO SYSTEMS

EDITOR'S NOTE

Comfortable? Good. Sit back, relax, and enjoy reading this month's issue of the QUOTA QUENCHER. Take your time, because when you have finished reading, you'll be so busy taking orders for our latest System of the Month that you will have precious little time for anything else!

This month's system will give you the opportunity to propose a properly designed and extremely cost-effective package of allowing access to two different trunk radio repeater sites (SMRS) utilizing two separate MOTRAR base stations controlled by a single Series-90 Extended Local Control Deskset! The system design allows a dispatcher to select a repeater site with the flick of a field installed switch mounted on the escutcheon of the deskset. In addition, the configuration provides simultaneous monitoring of both sites to ensure that no calls are missed. LED indicators on the deskset will tell the dispatcher which system is being monitored.

The MOTRARs and ancillary equipment will be installed in a closet or other "out-of-the-way" location, so the only piece of equipment on the dispatcher's desk will be the compact Series 90. Your customer will be very pleased with the "uncluttered" appearance of this type of installation.

The system described will allow the use of up to six desksets, although only one (the control point) may have the capability of site selection. To comply with FCC requirements, the control point unit must also be equipped with a Supervisory Switch. REMEMBER, each Series-90 must be located within one-hundred (100) feet of the control stations, even if only one deskset is used.

The featured system is meant for customers whose mobiles are not partitioned into separate subfleets. If selectable subfleet is required, or if your customer's dispatcher position is more than one-hundred feet from the base station location, fear not - WE CAN DO IT! These alternate systems are now documented so I can give you instant information.

If you have a customer who is a candidate for the April System of the Month, give me a call so we can discuss your specific application. You will also need to contact your Service Representative to receive a firm quote for the required field modifications, as well as normal installation.

- Pete Shroyer

DID YOU KNOW? A 6.0 dBd Yagi antenna (DB492) is now available for all 800 MHz control stations. This new antenna eliminates the requirements of an external attentuator to meet the FCC's "6 dB Rule" in systems utilizing a control station without variable power. Contact the ESCs for further information. - M.H.

COMING UP NEXT MONTH: "Applications for the Flexar Repeater".

Three-Hole Punched for Storage in Your Price Book or R3 Manual

PROPER SYSTEM DESIGN OF DUAL-SITE

TRUNK RADIO SYSTEM DISPATCH FACILITIES

Many trunk radio system users require the capability of accessing two separate trunk repeater sites (thus, two different Special Mobile Radio Systems, or SMRS) in order to realize the radio coverage required for their particular operation. While the Multiple Code Plug option on our Syntor-X Trunk Control Station provides for multiple site access, only one system can be monitored at a time, so many incoming calls will be missed. The addition of a special "scan" feature (that is being offered by one of the Los Angeles Service Shops) has been used in a few existing systems, but it is not a panacea. For example, although the field installed "scan" feature allows the trunk Syntor-X radio to look for activity on either system, the dispatcher can still only monitor one at a time; calls will still be missed! In addition, since there is no visual indication of which system is being monitored, the dispatcher does not have the means to know which site to select in order to respond to an incoming call.

From the scenario described above, it should be evident that the only viable system configuration for dual-site trunk system access is one that has the capability of allowing dispatch personnel to monitor both systems simultaneously AND gives the operator a visual indication of activity on either system. The only way to realize this is through the use of two separate control stations, each dedicated to its own trunk repeater site. This configuration not only ensures proper system operation, but also allows the sales force to offer cost-conscious customers less expensive control station equipment because the special Multiple Code Plug and field installed "scan" features are not required. Two MOTRAR control stations are ideally suited for this application.

For those customers who cringe at the thought of having two control stations sitting at their dispatcher's desk, Area 'F' Engineering has developed a method to control two MOTRARs with a single Series 90 Deskset (extended local control) or from a single T1604_M Control Console (tone remote control). Both system configurations allow the selection of four different subfleets, or three subfleets and a fleet call for each SMRS.

(Supplemental Information for the April, 1982 Quota Quencher)

TRUNK RADIO / SYSTEM COMPATIBILITY CHART

FLEET / SMRS CONSIDERATIONS	SYNTOR X	SYNTOR X2	SYNTOR X3	MITREK	MOTRAR 5	MOTRAR 20
	COMPATIBLE RADIOS					
SMRS with more than or planning to expand beyond 5 channels	YES	YES	YES Note 3	NO Note 1	NO Note 1	YES Note 3
Customer's original fleet comprised of 20 channel radios (on 20 channel SMRS)	YES	YES	YES	NO Note 2	NO Note 2	YES
Customer's original fleet comprised of 5 channel radios (on 5 channel SMRS)	YES	YES	YES	YES	YES	YES
SMRS may expand when new trunked frequencies are available	YES	YES	NO Note 3	NO Note 3	NO Note 3	NO Note 3

NOTES:

1. If the SMRS expands beyond 5 channels, any 5 channel radios sold on the system will not count towards the SMRS channel loading requirements.

2. When a customer is originally sold 20 channel radios, his fleet is designated as a 20 channel fleet. If the SMRS has more than 5 channels, a 20 channel radio is capable of assignment to any channel. A 5 channel radio can only be assigned to channels 1 through 5.

3. These radios will not be able to utilize new frequencies separated by more than 5 MHz from those existing.

MOTOROLA OFFERS A UNIQUE APPROACH TO SOLVING DISPATCH EQUIPMENT CONFIGURATION PROBLEMS IN A DUAL-SITE ACCESS TRUNK SYSTEM.

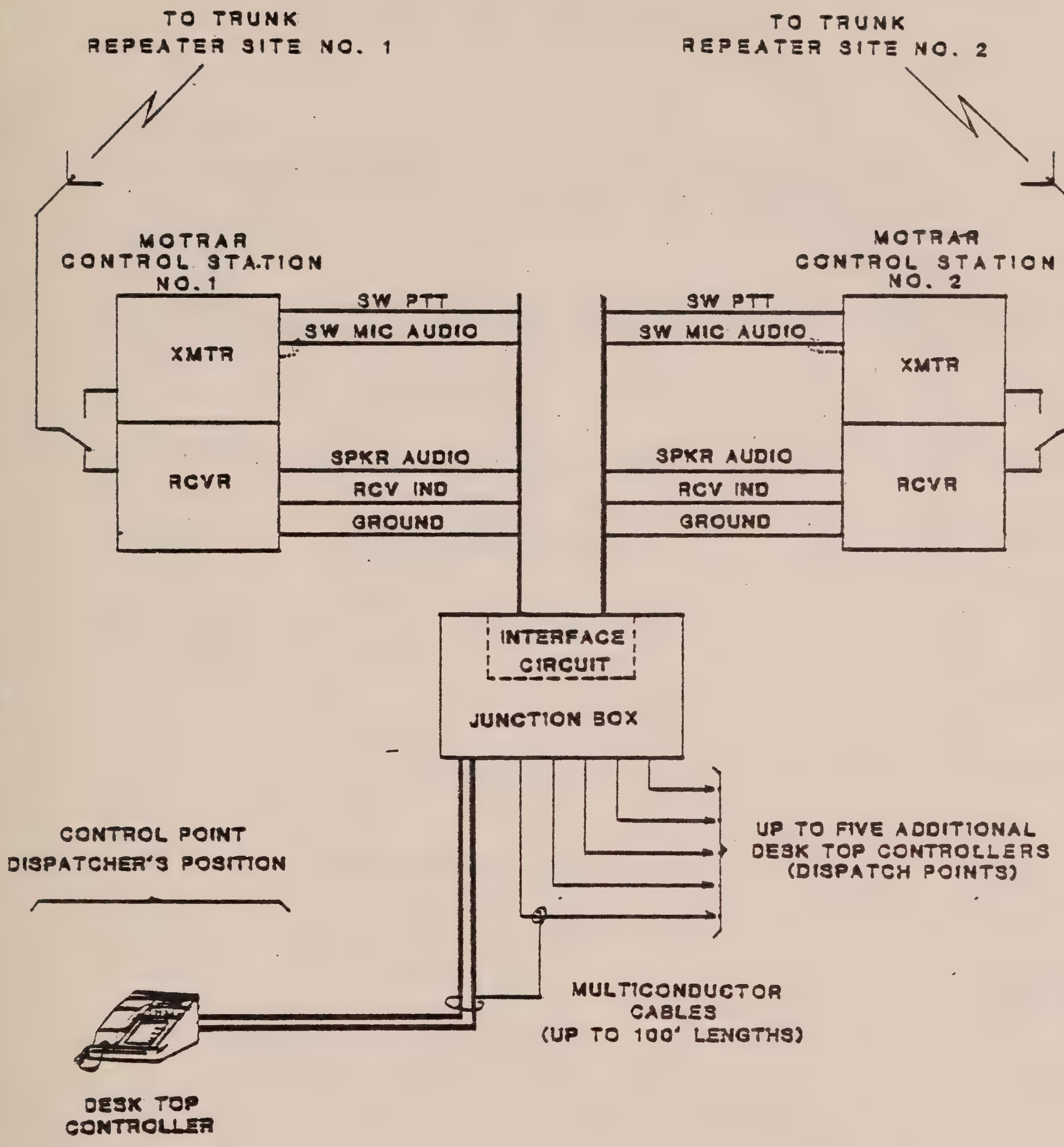
Motorola is pleased to present you with a dispatch system for your trunk radio fleet that is cost effective in approach and specifically tailored for your business operation. The system will allow your dispatcher to selectively access two trunk repeater sites using two separate trunk control stations. In addition, he or she will be able to monitor both sites simultaneously, ensuring that important incoming calls from mobile operators will not be missed. To maintain the professional atmosphere of your office, the control stations will be remotely located in a convenient, out-of-the-way location and be controlled by a stylish Series-90 desktop controller that will be installed on your control point dispatcher's desk. Up to five additional desksets may be added at anytime, as long as the dispatch points are located within one-hundred feet of the control stations. Since these additional units cannot be equipped with the site select feature, operators will be able to intercom to the control point dispatcher for site selection.

Operationally, your dispatcher will be able to monitor mobile activity on both systems through a loudspeaker that is contained within the desktop controller. Special Light Emitting Diode (LED) indicators have been added to the unit that will tell the dispatcher which system is active. If there is an incoming call which requires a response, the control point dispatcher need only look at the LED indication to see which site should be selected in order to respond.

When responding to or initiating a call, your dispatcher simply (1) lifts the Series-90 handset "off-hook", (2) selects the desired repeater site with a special switch on the control point deskset, and (3) proceeds to access a voice channel on the selected trunk system by depressing the Push-to-Talk (PTT) switch which is conveniently located in the handset. Note that when the handset is "off-hook", the deskset speaker is muted and receiver audio is routed to the earpiece in the handset, allowing a private conversation.

To allow the two control stations to be operated from the single desktop unit, a special "Dual-Site Access Interface Kit" has been installed in a junction box that will be collocated with the radios. Incidentally, the trunk control stations Motorola will be providing you with are economical MOTRAR's, our latest addition to an extensive line of trunk radio products. A complete description of this outstanding radio, plus a description of the flexible Series-90 Desktop Controller can be found in the brochures that accompany this proposal.

In summary, Motorola's offering will streamline your dispatch operations by providing an efficient approach to dual-site trunk system access. Your dispatcher's area will not be cluttered with unnecessary components, and you will realize years of dependable service from quality equipment manufactured by the leader of the communications industry.



MOTOROLA INC.

Extended Local Dispatch Equipment:
Dual Site System Access

BY: P. SHROYER
DATE: 2-17-82
NO: SOM0482
PAGE 1 OF 1

DUAL-SITE ACCESS TRUNK SYSTEM DISPATCH EQUIPMENT

EXTENDED LOCAL CONTROL

Price Control Date: April, 1982

ITEM NO.	MODEL NUMBER	DESCRIPTION	DISPATCHER'S LOCATION	EQUIPMENT ROOM	MISCELLANEOUS	TOTAL QUANTITY	UNIT $	EXTENDED $
1	L35WLB5170MSOM	MOTRAR 20 Trunk Control Station		2		2	1730.00	3,460.00
1a	B71	Omit Microphone		2		2	-78.00	(156.00)
1b	B206	Service Manual		1		1	N/C	N/C
2	DB-492	Antenna; 6.0 dBd Yagi			2	2	58.00	116.00
3	TDN6597-050	1/2" LDF Heliax Transmission Line, 50 Feet			2	2	177.50	355.00
4	T1884	Series 90 Deskset (Local Control)	1			1	296.00	296.00
4a	L48	Supervisory Switch (required if multiple desksets are used)	1			1	19.00	Optional
4b	L327	Delete Clock	1			1	-56.00	Optional
5	TLN1218	Junction Box		1		1	200.00	200.00
6	TKN6065B	Multiconductor Cable - 8 Feet		2		2	6.00	12.00
7	TKN6353B	Multiconductor Cable - 100 Feet			1	1	46.00	46.00
		EQUIPMENT SUB-TOTAL (Less Optional Items)						$ 4,329.00
		DUAL-SITE ACCESS KIT (Service Dept.)						$ 180.00
		TOTAL COST						$ 4,509.00

NOTE: Reference Item 2 to Dropship Quote No. DS03302-250.

Control No. SOM0482

EXTENDED LOCAL CONTROL

Description

In its basic form (one dispatcher, no subfleet selection), the extended local control configuration allows a dispatcher to operate two MOTRAR control stations from a single Series-90 deskset. Each control station is associated with an individual SMRS repeater site, and has its own dedicated antenna and transmission line. When the dispatcher wishes to initiate an outbound call, he or she selects the proper control station via a two-position rotary switch mounted on the Series-90 deskset. Monitoring inbound calls is simplified; the dispatcher monitors both sites simultaneously, as the receive audio from each control station is mixed before being routed to the deskset speaker/earpiece. In addition, CALL Lights (L.E.D.s) in the desksets will provide the dispatcher a visual indication of which control station the inbound call is being received on. Note that the operator does not have the capability of selectively muting either of the control station receivers. If engaged in a conversation on one system, inbound calls on the alternate system will still be heard.

If the system requires the use of selectable subfleet operation, an additional rotary switch is added to the Series-90. This four-position switch will provide subfleet selection for both SMRS, so the user's fleet partitioning must be carefully planned. To avoid operator confusion, whenever a SMRS site is selected by the dispatcher, THE ALTERNATE SYSTEM WILL AUTOMATICALLY REVERT TO SUBFLEET A. Therefore, the subfleet selection shown on the rotary switch is only applicable to the selected site.

Additional desksets may be added to the system using the same guidelines for conventional extended local control systems. However, these additional dispatch points will not have the capability of site selection and no provision has been made for CALL Lights at these locations. Personnel at these positions will need to intercom to the Control Point operator in order to select a site and/or particular subfleet. Note that a minor modification to the MOTRARS is required to facilitate intercom capability between desksets. Also, a Supervisory Switch will have to be provided with the Control Point deskset if multiple dispatch points are used.

Equipment Description (Refer to Drawing No. SOM0482L, pp.1-6)

The "black boxes" that make-up the extended local control configuration include: (1) A Series-90 deskset, (2) a TLN1218 Junction Box, (3) two MOTRAR control stations, and (4) a "Dual-Site Access Interface Kit". This "kit" is actually the parts and labor required to modify the standard equipment to work in this type of configuration, and detailed instructions for field modifications are provided. The actual piece parts are listed separately from the sample equipment lists provided with this documentation.

Technical Description - Extended Local Control

Site Selection

Referring to page 2 of the drawing, it can be seen that when the Site Select switch (S1) is in the "Site 1" position, RLY-1 (located in the junction box) is de-energized. Mic-Hi and PTT from the deskset are therefore routed through two of the normally closed contacts of the relay to Control Station #1. If Site 2 is selected, A+ is applied to the coil of RLY-1, causing it to energize. Mic audio and PTT are now routed through the normally open contacts of the relay to Control Station #2.

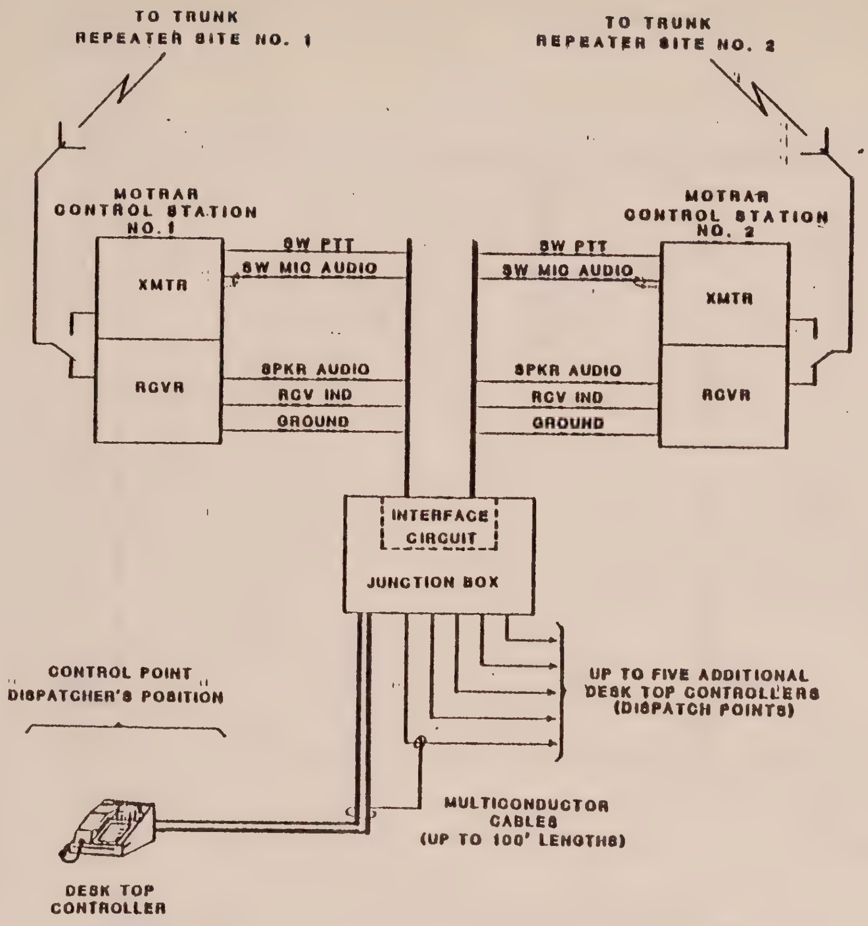
Subfleet Selection

If selectable subfleet is provided, selection must be made via switched ground closures at the MOTRAR radios. To accomplish this, switch contacts B, C, and D on the Series-90 Subfleet Selector switch (S2) are routed to "common" contacts on three different form 'C' closures associated with RLY-1. Therefore, subfleet selection is only applicable to the control station selected by the dispatcher. The alternate control station will always be operating in the Subfleet 'A' mode, as Subfleet 'A' is "selected" with an open contact. Page 4 of the drawing shows the internal wiring required in the radio for subfleet selection.

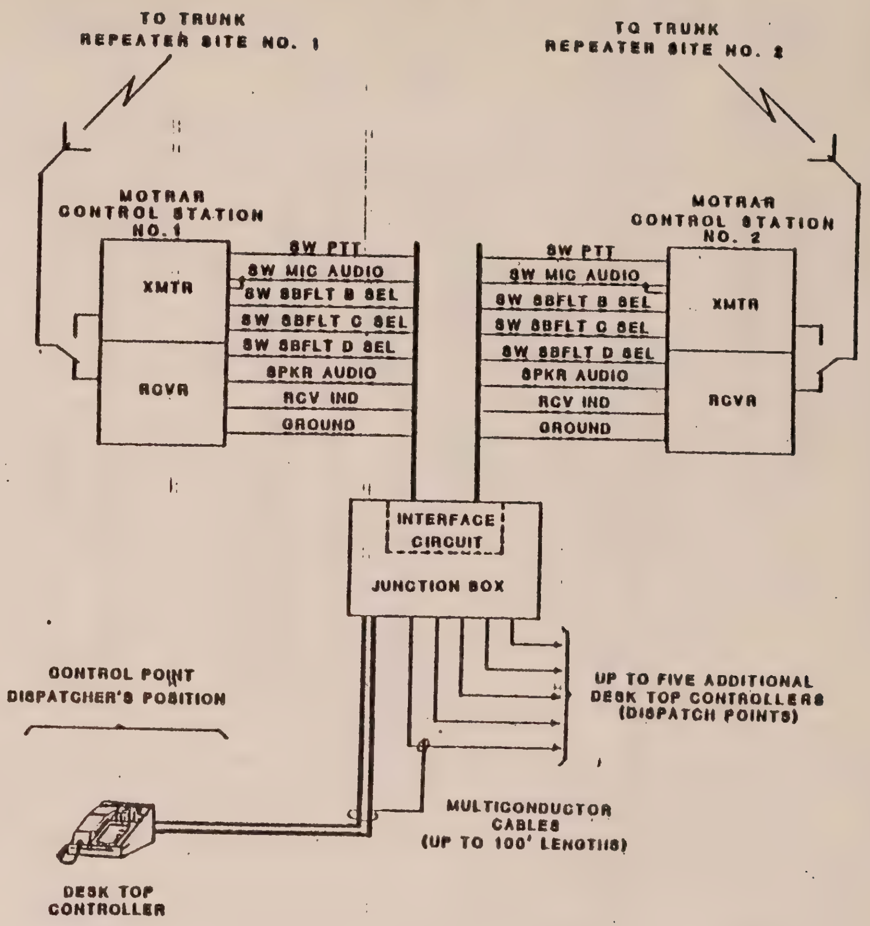
Receive Audio

Speaker audio from each control station is routed to the Junction Box where it is mixed via a minimum loss resistive pad (R1, 2, & 3). The mixed audio is routed to the deskset(s) speaker/earpiece.

An LED driver circuit consisting of Q1, R5, and CR2 (shown on page 3 of the drawing) will be provided in each MOTRAR radio. Q1 will provide a switched ground output whenever pin 14 of the microprocessor goes HI (speaker audio enable). These switched outputs will be brought out to the Control Point deskset and will cause the associated CALL Lights (DS1, DS2) to illuminate whenever there is fleet activity on the particular SMRS.



BASIC EXTENDED LOCAL CONTROL



EXTENDED LOCAL CONTROL
with
SELECTABLE SUBFLEET

MOTOROLA INC
Extended Local Dispatch Equipment
Dual Site System Access
BY: P. SHROYER
DATE: 2-17-
NO: 8OM0482L
PAGE 1 of 6

3818-70(B)

DUAL-SITE ACCESS TRUNK SYSTEM DISPATCH EQUIPMENT

EXTENDED LOCAL CONTROL - BASIC SYSTEM

Price Control Date: April, 1982

M NO.	MODEL NUMBER	DESCRIPTION	DISPATCHER'S LOCATION	EQUIPMENT ROOM	MISCELLANEOUS	TOTAL QUANTITY	UNIT $	EXTENDE
1	L35WLB5170MSOM	MOTRAR 20 Trunk Control Station		2		2	1730.00	3,460
1a	B71	Omit Microphone		2		2	-78.00	(156.
1b	B206	Service Manual		1		1	N/C	N/
2	DB-492	Antenna; 6.0 dBd Yagi			2	2	58.00	116.
3	TDN6597-050	1/2" LDF Heliax Transmission Line, 50 Feet			2	2	177.50	355.
4	T1884	Series 90 Deskset (Local Control)	1			1	296.00	296.
4a	L48	Supervisory Switch (required if multiple desksets are used)	1			1	19.00	Option
4b	L327	Delete Clock	1			1	-56.00	Option
5	TLN1218	Junction Box		1		1	200.00	200.
6	TKN6065B	Multiconductor Cable - 8 Feet		2		2	6.00	12.
7	TKN6353B	Multiconductor Cable - 100 Feet			1	1	46.00	46.
		EQUIPMENT SUB-TOTAL (Less Optional Items)						$ 4,329.
		DUAL-SITE ACCESS KIT (Service Dept.)						$ 180.
		TOTAL COST						$ 4,509.

NOTE: Reference Item 2 to Dropship Quote No. DS03302-250.

DUAL-SITE ACCESS TRUNK SYSTEM DISPATCH EQUIPMENT

EXTENDED LOCAL CONTROL W/SUBFLEET SELECT

Price Control Date: April, 1982

ITEM NO.	MODEL NUMBER	DESCRIPTION	DISPATCHER'S LOCATION	EQUIPMENT ROOM	MISCELLANEOUS	TOTAL QUANTITY	UNIT $	EXTENDED
1	L35WLB5170MSOM	MOTRAR 20 Trunk Control Station		2		2	1730.00	3,460
1a	B346	Four-Subfleet Selector		2		2	140.00	280
1b	B71	Omit Microphone		2		2	-78.00	(156
1c	B206	Service Manual		1		1	N/C	N/
2	DB-492	Antenna; 6.0dBd Yagi			2	2	58.00	116
3	TDN6597-050	1/2" LDF Heliax Transmission Line, 50 Feet			2	2	177.50	355
4	T1884	Series 90 Deskset (Local Control)	1			1	296.00	296
4a	L48	Supervisory Switch (required if multiple desksets are used)	1			1	19.00	Option
4b	L327	Delete Clock	1			1	-56.00	Option
5	TLN1218	Junction Box		1		1	200.00	200
6	TKN6065B	Multiconductor Cable - 8 Feet		2		2	6.00	12
7	TKN6349B	Multiconductor Cable - 100 Feet			2	2	41.00	82
		EQUIPMENT SUB-TOTAL (Less Optional Items)						$4,645
		DUAL SITE ACCESS KIT (Service Dept.)						190
		TOTAL COST						$ 4,835

NOTE: Reference Item 2 to Dropship Quote No. DS03302-250.

ELD MODIFICATION PARTS LIST
REV. 1 4-20-82

DUAL SITE TRUNK SYSTEM ACCESS

INTERFACE KIT

EXTENDED LOCAL CONTROL

P. Shroyer Price Control Date: 3-5-82

ITEM NO.	MODEL NUMBER	DESCRIPTION	SERIES 90 DESKSET	TLN1218 JUNCTION BOX	MOTRAR RADIO #1	MOTRAR RADIO #2								TOTAL QUANTITY	
														UNIT $	EXTENDED $
C1	08-82317B07	Capacitor; .015mf ± 10%			1	1							2	.88	1.76
CR1	48-82466H13	Diode; General Purpose		1									1	.75	0.75
CR2	48-83654H01	Diode; Silicon			1	1							2	.43	.86
DS1,2	48-84404E05	LED (Yellow)	2										2	.43	0.86
Q1	48-869570	Transistor; M9570			1	1							2	1.50	3.00
R1-3	17-82177B03	Resistor; 4 ohm, 5W		3									3	.22	.66
R4	06-125C47	Resistor; 820 ohm, 1/2W (pkg of 10)	1										1	1.31	1.31
R5	06-124C87	Resistor; 39K ohm, 1/4 W (Pkg of 10)			1ea	1ea							1	1.48	1.48
R6	06-124B10	Resistor; 330K ohm, 1/2W (pkg of 10)			1ea	1ea							1	2.89	2.89
S1	40-5376B01	Switch, Rotary; 2 Position(Site Sel)	1										1	14.36	14.36
	40-5376B03	Switch, Rotary; 4 Position(Subfleet)	1										1	31.25	Optional
RLY-1	R10-E1-Y6-V90*	Relay; 6PDT 12 VDC Potter Brumfield		1									1	15.00	15.00
		NON-REFERENCED ITEMS													
1	36-82262J01	Knob; Site Select Switch	1										1	1.98	1.98
		Knob; Subfleet Switch	1										1	1.98	Optional
2	27E127*	Relay Socket; Potter Brumfield		1									1	2.00	2.00
3	2DC251*	Relay Hold-Down Spring, P & B		1									1	.16	.16
4	29-84706E05	Terminal Pins (Male)			10	10							20	.30	6.00
5	29-82336A01	Terminal Pins (Female)			10	10							20	.30	6.00
6	31-82226C01	Barrier Strip		3									3	3.71	11.13
		TOTAL PARTS COST (DNUP)													$ 70.20

* Must be ordered on STIC-1. Reference to Dropship Quote No. DS01272-3.

REV. 1 4-20-82

DUAL-SITE TRUNK SYSTEM ACCESS

FIELD MODIFICATIONS

EXTENDED LOCAL CONTROL CONFIGURATION

(Refer to Drawing No. SOM0482-L)

I. SERIES-90 DESKSET (See pages 2 & 6 of drawing)

A. The following modifications are required for all installations:

1. Add Site Select Switch (S1).
   - a. Mount switch as shown on page 6 of drawing.
   - b. Remove jumpers JU1B and JU2 on the Main Board.
   - c. Isolate Screw Terminal No. 7
   - d. Wire the "common" contact of S1 to deskset A+.
   - e. Wire the "normally open" contact of S1 to Screw Terminal No. 9.

2. Add a jumper between J6-17 and J6-26.

3. Add CALL Indicators (DS1, DS2)
   - a. Mount the LED's as shown on page 6 of drawing.
   - b. Isolate screw terminals 7 & 10.
   - c. Add R4 as shown on page 2 of drawing.
   - d. Wire DS1 and DS2 as shown on page 2 of drawing.

B. If Selectable Subfleet is required, perform the following additional modifications:

1. Add Subfleet Select Switch (S2).
   - a. Mount switch as shown on page 6 of drawing.
   - b. Isolate screw terminals 8 & 6.
   - c. Add additional screw terminal as shown on page 2 (SP). Note: If Supervisory Switch is not used, screw terminal #3 can be used instead.
   - d. Wire contacts on S2 as follows:
     - i. Subfleet A - No Connection
     - ii. Subfleet B - To screw terminal #8
     - iii. Subfleet C - To screw terminal #6
     - iv. Subfleet D - To screw terminal # "SP"
     - v. Common - To screw terminal #2 (ground).

C. Provide Labeling for Deskset Escutcheon as Shown on page 6 of Drawing.

1. Engraving is suggested if cost is not prohibitive.

II. JUNCTION BOX (see page 2 of drawing).

A. Add Barrier Strips (TB1 & TB2) as shown on the accompanying photographs.

B. Add RLY-1 as shown on the accompanying photographs.

1. Connect CR1 across relay coil.

C. Add Resistors R1, R2, & R3.

1. Connect as shown on drawing.

D. Wire relay contacts to TB1/TB2 as shown on drawing.

III. MOTRAR RADIOS (see pages 2, 3 and 4 of drawing.)

A. The following modifications are required for all installations:

1. Remove jumper between P601-12 and P601-9 (power supply cable).
   a. This disables the local speaker.

2. Isolate J601-7.

3. Add Q1, R5, and CR2 shown on page 3 of Drawing. (As there is little room on the processor board, these components can be "potted", placed in shrink tubing, and mounted in any convenient location).
   a. Wire collector of Q1 to J601-7.

B. If Selectable Subfleet has been provided, perform the following additional modifications:

1. Isolate J601-9 from the internal radio speaker

2. Add the following jumpers from J601 to the normally open contacts of the Subfleet Selector Switch:
   a. Subfleet A - No Connection
   b. Subfleet B - J601-1
   c. Subfleet C - J601-11
   d. Subfleet D - J601-9

C. If multiple desksets are used, perform the following additional modifications to allow full duplex intercom and control point monitoring:

1. Add C1 and R6 as shown on page 5 of the drawing.
   a. These components can be mounted on the solder side of the RF/Audio Board.

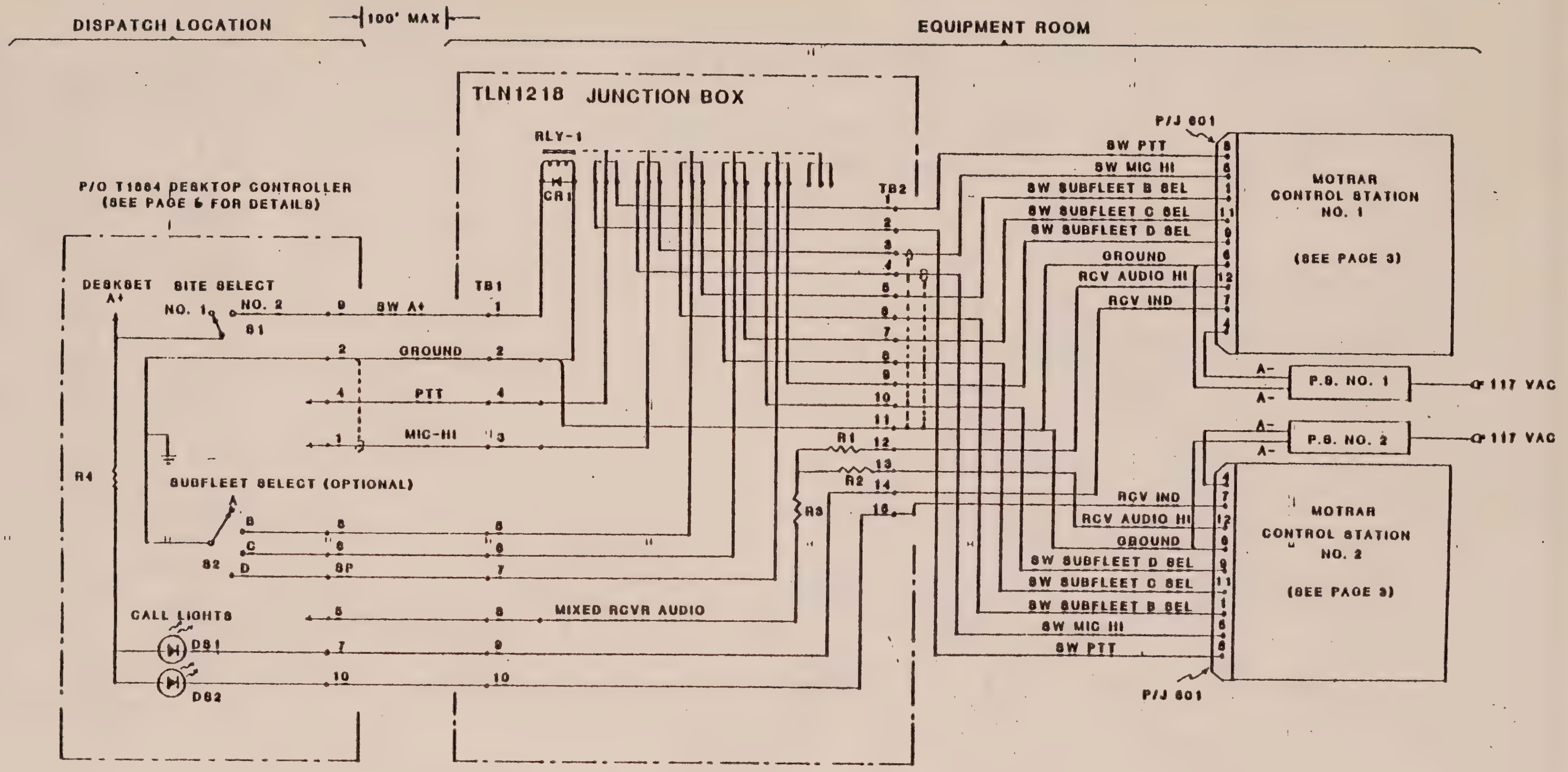
V. INTERCABLING (refer to page 2 of drawing)

A. Deskset to Junction Box

1. Make connections from deskset screw terminals to TB1 as shown on drawing.
    - a. Existing lugs on deskset multiconductor cables can be used.

B. Junction Box to Radios

1. Make connections from TB2 to the P601 connectors (p/o MOTRAR power supply cables) as shown on drawing.
    - a. The lugs on the radio end of the multiconductor cables supplied will have to be removed. They will be replaced with the male terminal pins (supplied) that will be fitted into P601. Additional female pins (supplied) will also be required for J601.



EXTENDED LOCAL CONTROL
FUNCTIONAL BLOCK DIAGRAM

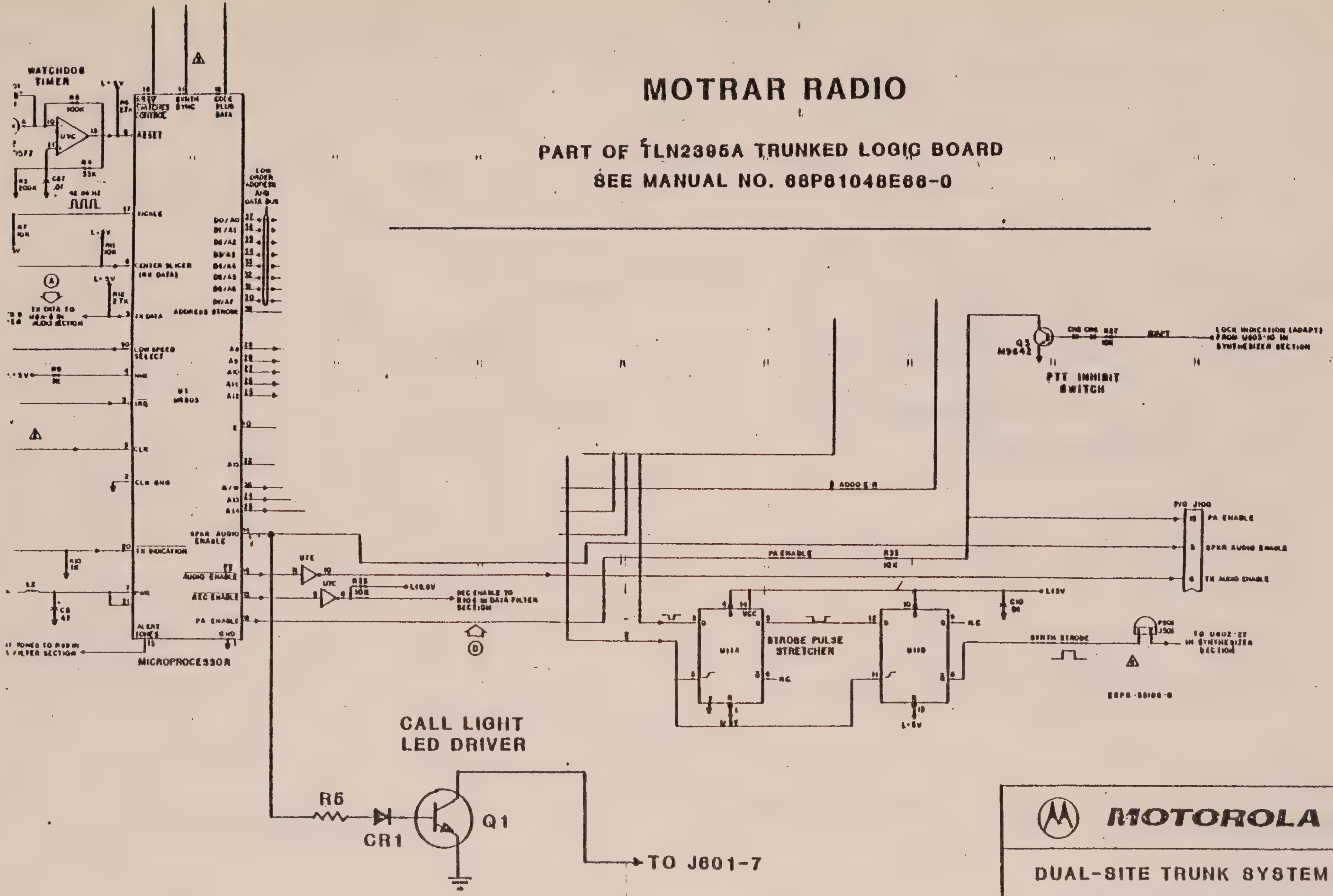
MOTOROLA INC.

DUAL SITE TRUNKED SYS. ACCESS
EXTENDED LOCAL CONTROL

BY: P. SHROYER	DATE: 2-28-82
NO: SOM0482L	PAGE 2 OF 6

MOTRAR RADIO

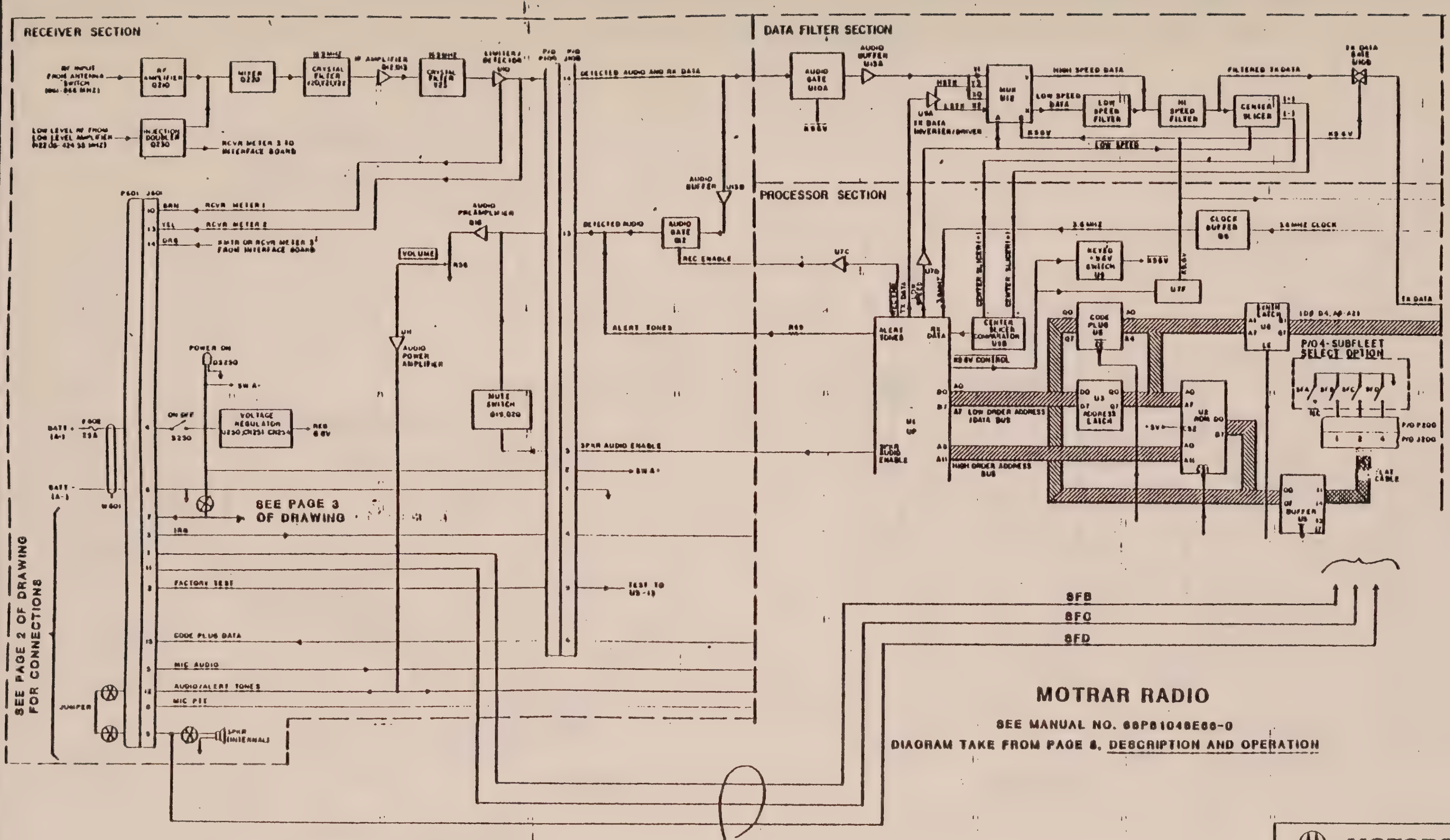
PART OF TLN2395A TRUNKED LOGIC BOARD
SEE MANUAL NO. 68P81048E66-0



MOTOROLA INC.

DUAL-SITE TRUNK SYSTEM ACCESS
MOTRAR RADIO MODIFICATIONS

BY: P. SHROYER	DATE: 4/20/82
NO: SOM0482-L	PAGE 3 OF 6



MOTRAR RADIO

SEE MANUAL NO. 68P81046E66-0

DIAGRAM TAKE FROM PAGE 6, DESCRIPTION AND OPERATION

ADD JUMPERS IF SELECTABLE SUBFLEET IS REQUIRED

NOTE: ⊗ INDICATES CUT

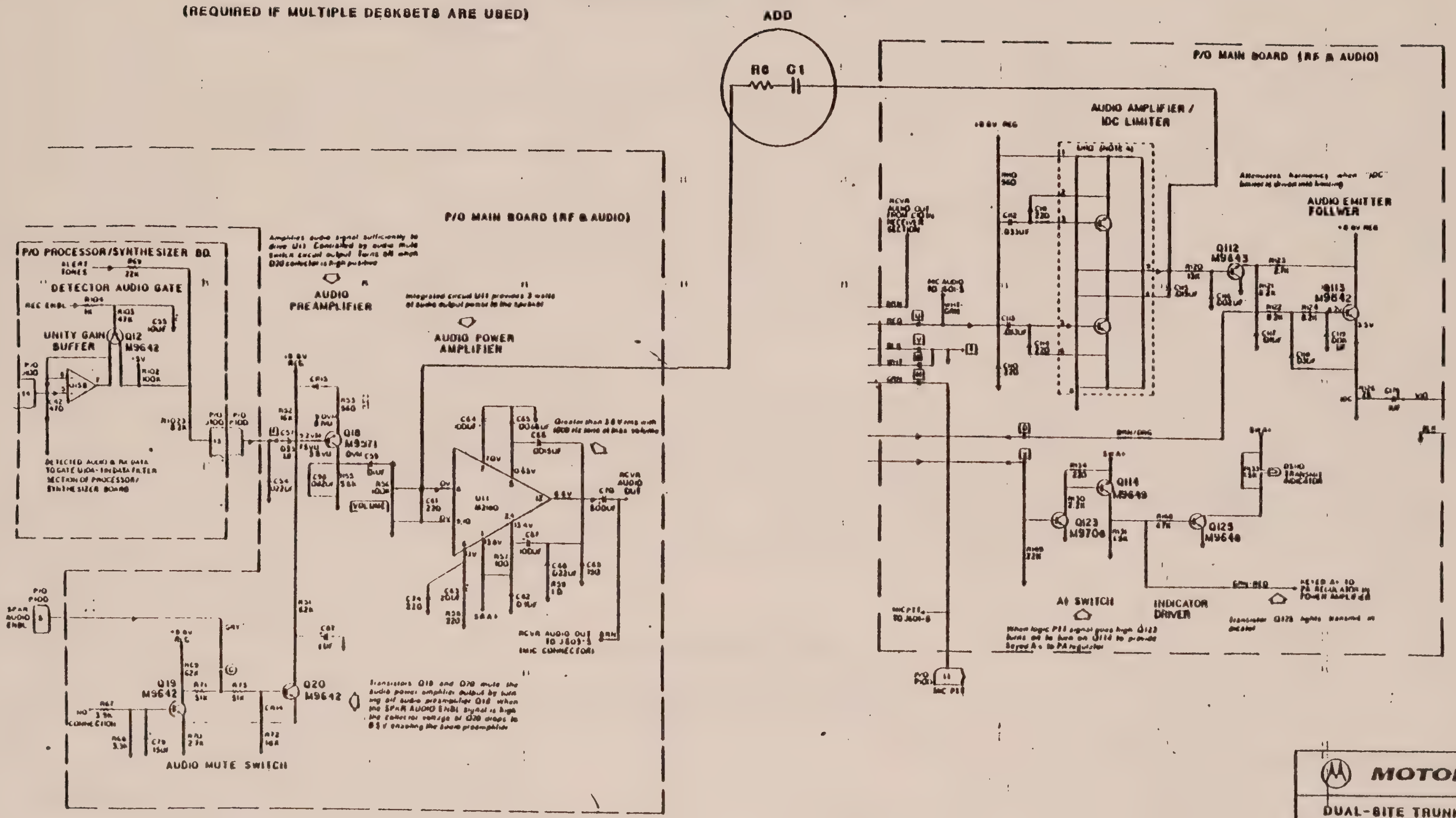
MOTOROLA INC.	
DUAL-SITE TRUNKED SYSTEM ACCESS MOTRAR RADIO MODIFICATIONS	
BY: P. SHROYER	DATE: 4/20/82
NO: 80M0482-L	PAGE 4 OF 6

3818-70(B)

REV. 1
]

MOTRAR RADIO

INTERCOM AND MONITOR MODIFICATION
(REQUIRED IF MULTIPLE DESKSETS ARE USED)



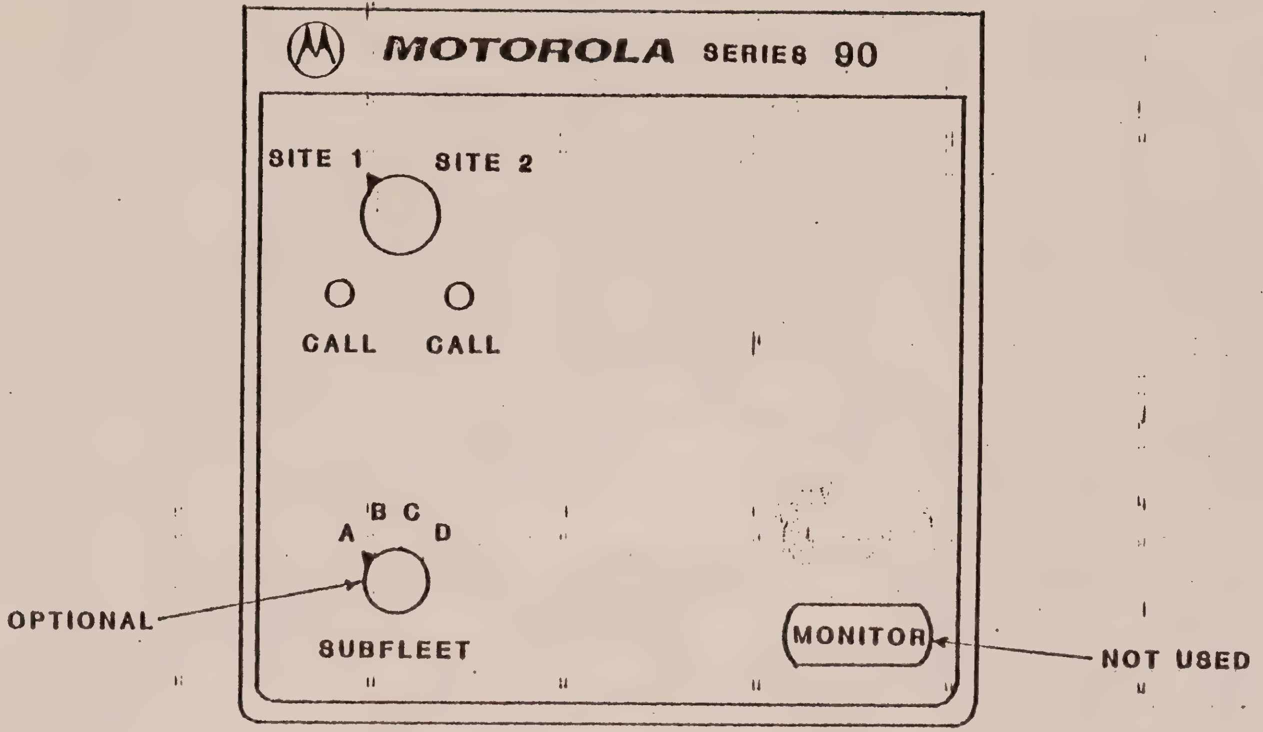
MOTOROLA INC.

DUAL-SITE TRUNK SYSTEM ACCESS
MOTRAR RADIO MODIFICATIONS

BY: P. SHROYER	DATE: 4/20/82
NO: 80M0482-L	PAGE 5 OF 6

3818-70(B)

REV. 1

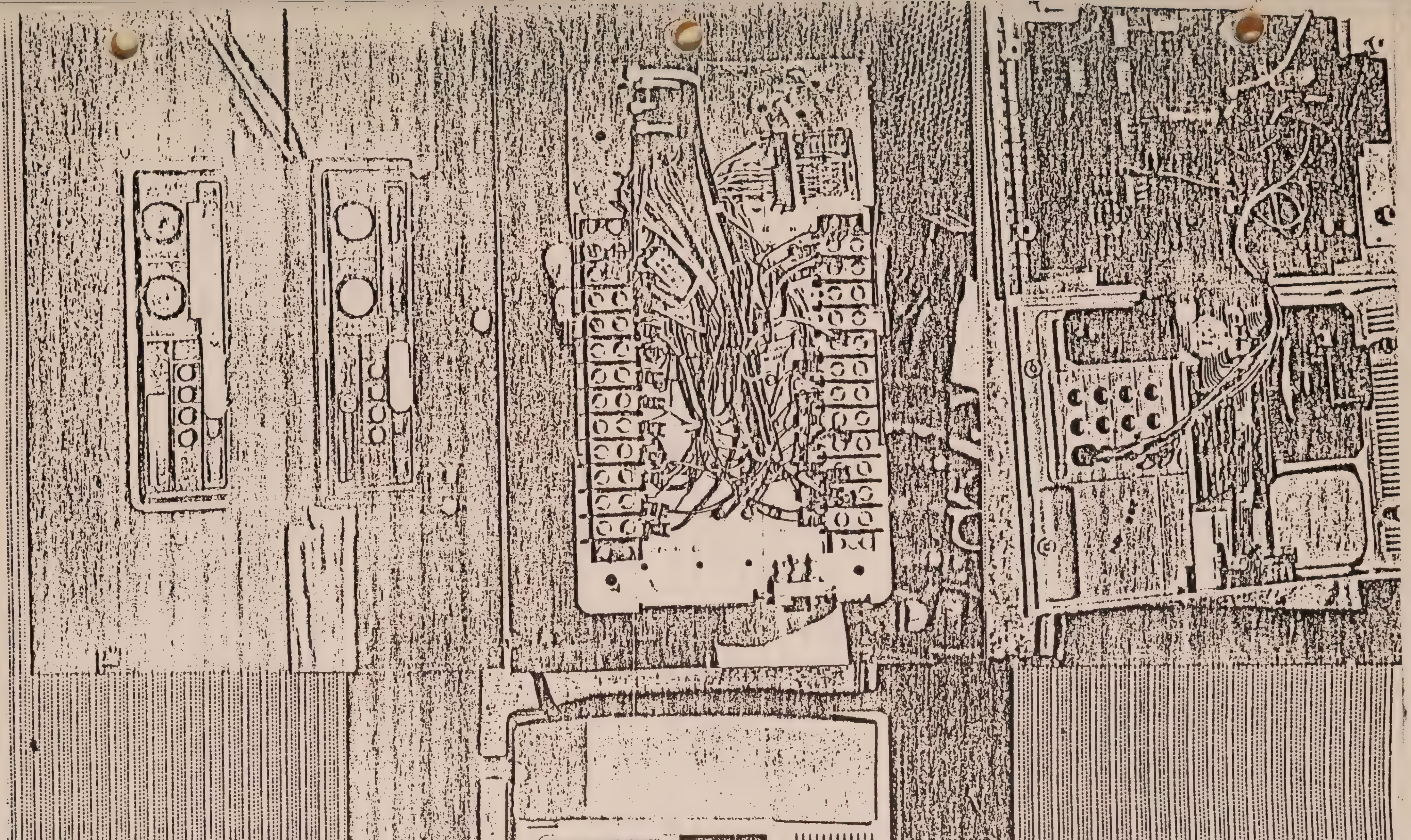


SERIES 90
ESCUTCHEON

NOTES:

1. SITE SELECT SUBFLEET SWITCHES, AND CALL INDICATORS (LED's) INSTALLED IN FIELD.
2. ENGRAVING IS DONE IN THE FIELD.

MOTOROLA INC.	
DUAL SITE TRUNK SYSTEM ACCESS EXTENDED LOCAL CONTROL	
BY: P. SHROYER	DATE: 2-26-82
NO: 80M0482-L	PAGE 6 OF 6



TONE REMOTE CONTROL

Description

This configuration is required for customers whose control point is greater than one-hundred cable feet away from the Motrar radios. Operationally, it is similar to the extended local configuration, although it will be much more costly to implement in terms of equipment and labor.

The basic configuration will allow a dispatcher to control two Motrar control stations from a single T1604_M Tone Remote Console. Tone remote control adapters will be required at the Motrar location to accomplish this task. A special interface board (external to the console) will allow dual-site access and simultaneous monitoring. Operator selection of the site is accomplished with an accessory switch on the console, and incandescent CALL Lights (also on the console) will provide a visual indication of activity on each SMRS.

If selectable subfleet is provided, a Four-Frequency Switch Kit will have to be added to the console, and T4/R4 tone remote adaptors will be required. The use of this "four-frequency" control format means that each time a subfleet is selected, the operator will have to briefly depress the console PTT switch in order to send the proper function command to the selected remote adaptor/radio. As with the extended local configuration, the subfleet selection is only valid for the control station selected with the "Site" switch, and the alternate control station will always be in the Subfleet 'A' mode.

Equipment Description (Refer to Drawing No. SOM0482T, pp. 1-4)

Overview

The "black-boxes" that make up the tone remote configuration include: (1) A T1604_M console, (2) two remote control adaptors, (3) a line amplifier with power supply, (4) a special "Dual Site Interface Board", and (5) two Motrar control stations.

Interface Board

The interface board has three primary purposes: First, it facilitates site selection through the use of a DPDT relay activated by the Accessory (Site Select) Switch (S2) on the console. Second, it provides receiver audio mixing through the use of a 6dB mimimum loss pad. Third, it provides two identical Voice Operated Indicator (V.O.I.) circuits that are used to activate the CALL Lights in the console. The interface board must be within ten feet of the console.

Line Amplifier

The Lorraine Telephone Electronics 460C amplifier and associated 24Vdc power supply will be collocated with the interface board. It is used to provide the proper level of mixed receive audio to the console. It is possible that the amp will not be required for applications using in-house lines, although its use is recommended.

T1604-M Console

The console will be shipped from the factory equipped with a Handset, Four-Wire Audio Adaptor, and, if selectable subfleet is required, a Four-Frequency Switch Kit. The Accessory (Site Select) Switch will be shipped separately. The console MUST be strapped for full duplex operation in the field. This is a standard modification used for handset operation, and instructions are in the manual. This modification is required so the operator will be able to hear the "talk-prohibit" tone if a voice channel is not available. Note that a "Busy" light is not provided.

Additional field modifications will include adding the CALL Lights and some minor jumper additions/deletions.

Remote Control Adaptors

Two tone remote control adaptors will be provided (one per control station) and will be collocated with the radios. For the basic system, the Q1224 (T1R1) version will be used, while systems using selectable subfleet operation will require a Q1222 (T4R4) unit. The adaptors are used to convert function tones from the control console into contact closures for radio control, as well as matching 600 ohm transmit audio to the mic-level inputs of the Motrars.

Technical Description (Refer to pages 2 and 4 of drawing)

Site Selection

Individual transmit audio/control lines from Sites 1 & 2 are respectively routed to the normally open and normally closed contacts of RLY-1 on the interface board. When the operator selects "Site 1" on the Site Select Switch, +12Vdc is applied to the relay coil, causing it to energize. The transmit audio/control line for Site #1 is now routed directly to the 4W transmit output of the console. Conversely, when the operator selects "Site 2", 12Vdc is removed from the relay coil, and the relay is de-energized. The "Site 1" transmit audio/control line is now removed from the console, and the "Site 2" line is connected. Back-loading the disconnected lines is not necessary.

Subfleet Selection

In systems configured for multiple subfleets, operator selection is made via a Four-Frequency (Subfleet) Switch Kit on the console. The function tones associated with each subfleet will be as follows:

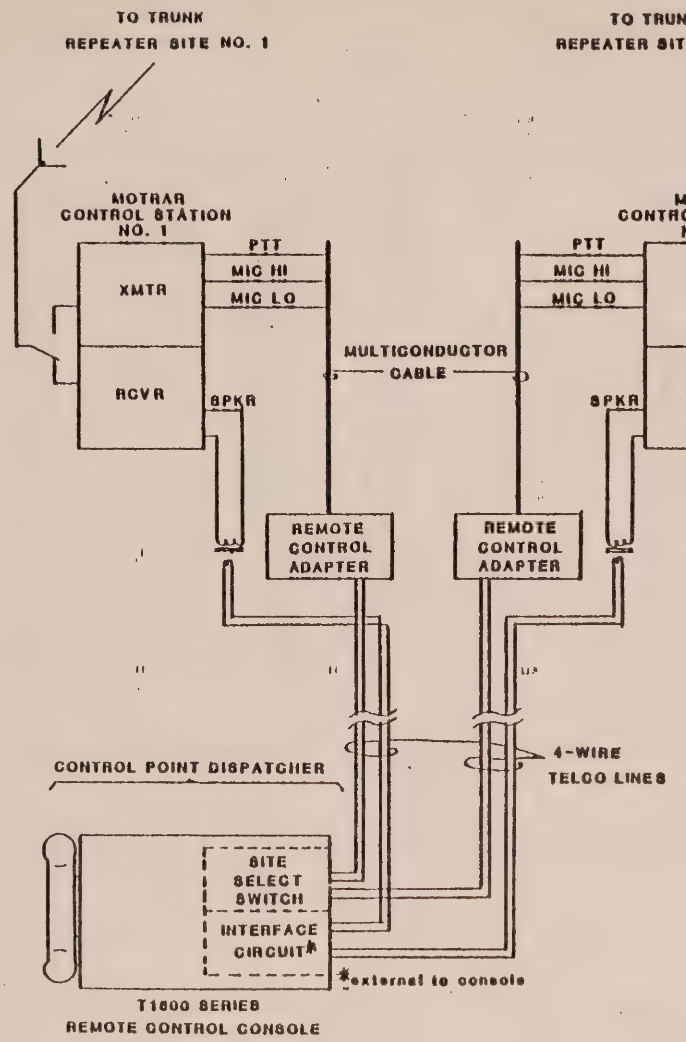
Subfleet 'A' = 1950 Hz (F1)
Subfleet 'B' = 1850 Hz (F2)
Subfleet 'C' = 1350 Hz (F3)
Subfleet 'D' = 1250 Hz (F4)

When the operator depresses the desired selector switch, the proper function tone will be sent only after the PTT switch has been mommentarily depressed. The function tone will be sent over the selected transmit line, and will be decoded by the associated tone remote adaptor at the radio location. After the tone is properly decoded, an associated relay contact closure in the remote adaptor will latch and provide the necessary ground to the Motrar for the proper subfleet selection. In addition, the PTT output of the selected adaptor will provide a momentary ground closure that will reset the frequency (subfleet) bistable circuits associated with subfleets B, C, and D in the alternate remote adaptor. This feature will cause the alternate control station to always operate in the Subfleet 'A' mode when it is not selected for use.

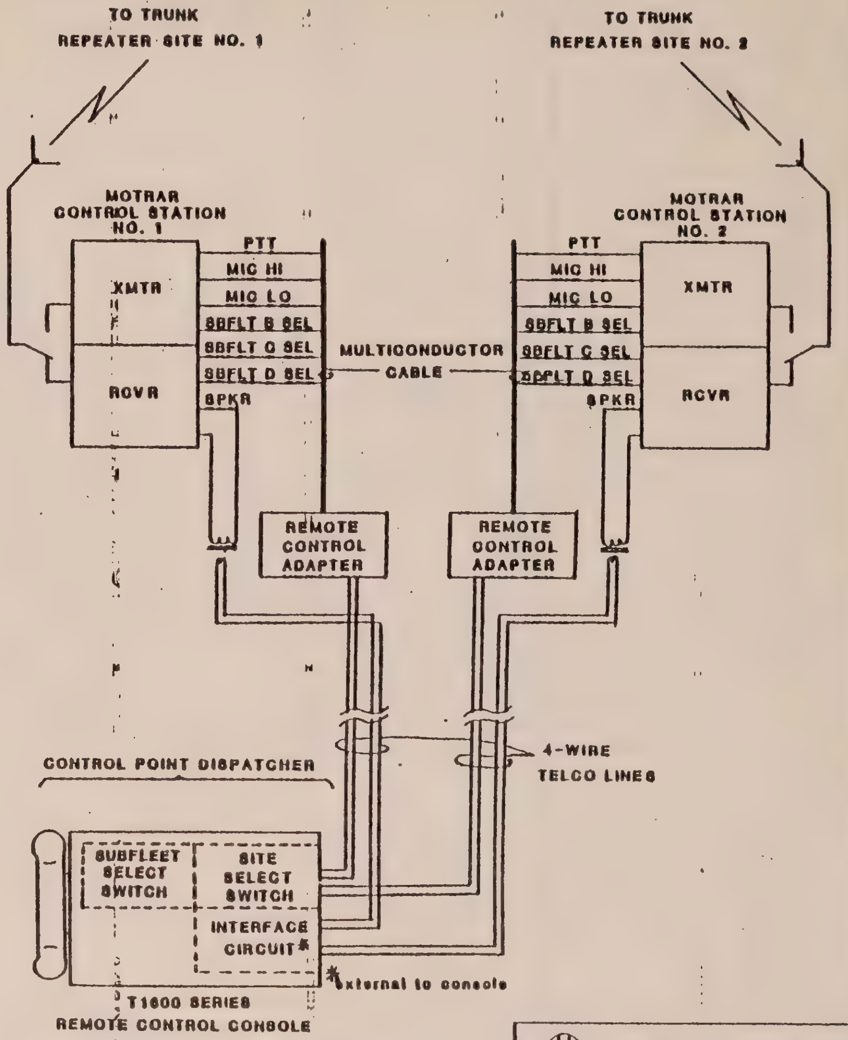
Receive Audio

Since there is no provision for line audio output on the Motrar radios, and since four-wire operation is mandatory in remote trunk systems, a voice coil -to-line transformer has been provided for each control station. The transformers will match the 4 ohm speaker audio output of the radios to a 600 ohm line.

The individual receive audio lines are routed to the interface board at the console location, where the audio is mixed and fed to the input of the LTE 460C amplifier. In addition, each individual line also feeds a bridging (10K/12K) transformer to provide an audio signal to an associated V.O.I. circuit on the interface board. The V.O.I. circuits incorporate a "zero-crossing reference" I.C. which provides an A.C. output that corresponds to the voice signals on the line. The A.C. output is used to drive CALL Lights on the console.



BASIC TONE REMOTE CONTROL



TONE REMOTE CONTROL
with
SELECTABLE SUBFLEET

MOTOROLA INC.

Tone Remote Dispatch Equipment:
Dual Site System Access

BY: P. SHROYER	DATE: 2-17-82
NO: SOM0482T	PAGE 1 of 4

3818-70(B)

DUAL-SITE ACCESS TRUNKED SYSTEM DISPATCH EQUIPMENT

TONE REMOTE CONTROL

Price Control Date: April, 1982

ITEM NO.	MODEL NUMBER	DESCRIPTION	DISPATCHER'S LOCATION	REMOTE LOCATION	MISCELLANEOUS	TOTAL QUANTITY	UNIT $	EXTENDE
1	L35WLB5170MSOM	MOTRAR 20 Trunked Control Station		2		2	1730.00	3,460.
1a	B71	Omit Microphone		2		2	-78.00	(156.
1b	B206	Service Manual		1		1	N/C	N/
2	DB-492	Antenna; 6.0dBd Yagi		2		2	58.00	116.
3	TDN6597-050	1/2" LDF Heliax Transmission Line, 50 Feet		2		2	177.50	355.
4	T1604-M	Tone Remote Control Console	1			1	924.00	924.
4a	L109	Handset	1			1	162.00	162.
4b	L144	Four-Wire Audio Adaptor	1			1	65.00	65.
4c	L48	Supervisory Switch (required if multiple consoles are used)	1			1	51.00	Option
4d	L59	Line Operated Transmit Light (required if multiple consoles are used)	1			1	122.00	Option
5	Q1224	Tone Remote Adaptor (T1/R1)		2		2	882.00	1,764.
6	TKN6065B	Multiconductor Cable - 8 Feet		2		2	6.00	12.
[illegible]	DO-T4	UTC/TRW Line Transformer		2		2	15.00	30.
8	460C	Line Amplifier (LTE)	1			1	159.00	159.
9	PS15	Power Supply for Item 8	1			1	69.00	69.
10	13227	Mounting Assembly for Item 8	1			1	24.00	24.
		EQUIPMENT AND PARTS TOTAL (Less Optional and A/R Items)						$ 7,164.
		DUAL-SITE ACCESS INTERFACE KIT (Service Department)						
		TOTAL COST						

NOTES:

1) Reference Item 2 to Dropship Quote No. DS03302-250.

2) Reference Items 8-10 to Dropship Quote No. DS03082-3.

3) Reference Item 7 to Dropship Quote No. DS03102-50.

DUAL-SITE ACCESS TRUNKED SYSTEM DISPATCH EQUIPMENT

TONE REMOTE CONTROL W/SUBFLEET SELECT

Price Control Date: April, 1982

ITEM NO.	MODEL NUMBER	DESCRIPTION	DISPATCHER'S LOCATION	REMOTE LOCATION	MISCELLANEOUS	TOTAL QUANTITY	UNIT $	EXTENDED
1	L35WLB5170MSOM	MOTRAR 20 Trunked Control Station		2		2	1730.00	3,460.
1a	B346	Four-Subfleet Selector		2		2	140.00	280.
1b	B71	Omit Microphone		2		2	-78.00	(156.
1c	B206	Service Manual		1		1	N/C	N/
2	DB-492	Antenna; 6.0dBd Yagi		2		2	58.00	116.
3	TDN6597-050	1/2" LDF Heliax Transmission Line, 50 Feet		2		2	177.50	355.
4	T1604-M	Tone Remote Control Console	1			1	924.00	924.
4a	L109	Handset	1			1	162.00	162.
4b	L144	Four-Wire Audio Adaptor	1			1	65.00	65.
4c	L48	Supervisory Switch (required if multiple consoles are used)	1			1	51.00	Optiona
4d	L59	Line Operated Transmit Light (required if multiple consoles are used)	1			1	122.00	Optiona
4e	L226	Intercom (required if multiple consoles are used)	1			1	43.00	Optiona
	L66	Four Frequency Switch	1			1	137.00	137.
5	Q1222	Tone Remote Adaptor (T4/R4)		2		2	1259.00	2,518.
6	TKN6065B	Multiconductor Cable - 8 Feet		2		2	6.00	12.
7	DO-T4	UTC/TRW Line Transformer		2		2	15.00	30.
8	460C	Line Amplifier (LTE)	1			1	159.00	159.
9	PS15	Power Supply for Item 8	1			1	69.00	69.
10	13227	Mounting Assembly for Item 8	1			1	24.00	24.
		EQUIPMENT SUB-TOTAL (Less Optional Items)						$ 8,155.0
		DUAL-SITE ACCESS INTERFACE KIT (Service Department)						
		TOTAL COST						$

NOTES:

1. Reference Item 2 to Dropship Quote No. DS03302-250.
2. Reference Items 8-10 to Dropship Quote No. DS03082-3
3. Reference Item 7 to Dropship Quote No. DS03102-50

FIELD MODIFICATIONS PARTS LIST

DUAL SITE TRUNK SYSTEM ACCESS
INTERFACE KIT

TONE REMOTE CONTROL

P. Shroyer Price Control Date: 3-5-82

ITEM NO.	MODEL NUMBER	DESCRIPTION	INTERFACE BOARD	T1604 M CONSOLE	MOTRAR RADIO NO. 1	MOTRAR RADIO NO. 2	MISCELLANEOUS (DISPATCH LOCATION)	MISCELLANEOUS (REMOTE LOCATION)					TOTAL QUANTITY	UNIT $	EXTENDED $
C1,C2	21-82447C01	Capacitor, Ceramic, .005 mf	2										2	.97	1.94
C3,C4	23-82077C04	Capacitor, Electrolytic; 1000mf, 15 Vdc	2										2	4.54	9.08
CR1	48-82466H13	Diode, General Purpose	1										1	.75	0.75
DS1,2	65-82664K01	Lamps; 5.0V, .06A (incl. socket)		2									2	1.69	3.38
RLY-1	TLN4151	Relay; 12 Vdc DPDT	1										1	37.00	37.00
RA	06-125A25	Resistor; 100ohm 1/2W 5% (pkg of 10)	1										1	2.63	2.63
R1,2	06-124B26	Resistor; 1.5M 1/2W 5% (pkg of 10)	1										1	2.84	2.84
S1	TLN1507	Accessory Switch (Site Select)		1									1	57.00	57.00
[illegible]	TLN1506	Four Frequency (Subfleet) Switch		1									1	147.00	Optional
,2	DO-T36*	Transformer, Bridging; TRW/UTC	2										2	29.00	58.00
U1,2	RL-MC3370P	Integrated Circuit; Motorola S.G.	2										2	4.00	8.00
U3	51-84320A81	I.C. Voltage Regulator (MC7915)	1										1	8.40	8.40
1	4112-5*	Vector Plugboard; 4 1/2" x 4 1/2"	1										1	18.00	18.00
2	R644*	Vector Plugboard Receptacle	1										1	7.00	7.00
3	AC-402*	BUD Aluminum Chassis (5x7x2)	1										1	7.00	7.00
4	31-82226C02	Terminal Strip (TB2)						1					1	4.99	4.99
5	29-84706E05	Terminal Pins			10	10							20	.30	6.00
6	29-82336A01	Terminal Pins (Female)			10	10							20	.30	6.00
7	09-80313A09	I.C. Socket	2										2	.90	1.80
		TOTAL PARTS COST - DNUP (Less optional items)													$ 239.81

* NOTE: Items with asterisk must be ordered from local vender or on Stic-1. Reference to Dropship Quote No. DS-31025-50. All other items are available through Motorola Parts.

DUAL-SITE TRUNK SYSTEM ACCESS

FIELD MODIFICATIONS

TONE REMOTE CONTROL CONFIGURATION

(Refer to Drawing No. SOM0482-T)

I. T1604_M CONTROL CONSOLE (See page 2 of drawing)

A. Isolate the following screw terminals

1. 6 (remove JU18)

2. 15 (cut etching)

B. Install the TLN1507 Accessory (Site Select) Switch in position C5.

1. Refer to PEPS-9759-C in console manual for following modifications:
   a. Connect switch contact 3B to P1-10 (+12V)
   b. Connect switch contact 3C to P1-8

2. Route a jumper from C5-28 to screw terminal #15.

C. Install the CALL indicators (DS1, DS2) in the blank escutcheon over position C4.

1. Wire the "high" side of DS1 to screw terminal #22.

2. Wire the "high" side of DS2 to screw terminal #7.

3. Wire the "low" sides of DS1 & DS2 to screw terminal #6.

D. Wire console for full-duplex capability.

1. Refer to manual for instructions.

E. Install TLN1506 Four-Frequency (Subfleet Select) Switch in position A-2 (optional).

1. Refer to manual for instructions.

II. INTERFACE BOARD (Refer to page 2 of drawing)

A. Fabricate the Interface Board using the schematic shown on drawings as a reference.

1. The actual board layout and pin allocations will be determined by the MSS.

2. Mount the finished board in the aluminum chassis box that has been provided.

B. The Interface Chassis, the 460C Line Amplifier, and the 24Vdc Power Supply should be collocated in an area not more than ten feet from the console.

III. MOTRAR RADIOS

A. Remove the jumper between P601-9 and P601-12 (power supply cable).

B. If selectable subfleet has been provided, perform the following additional modifications:

1. Isolate J601-9 from the internal radio speaker.

2. Add the following jumpers from J601 to the normally open contacts of the subfleet selector switch:
    a. Subfleet A - No Connection
    b. Subfleet B - J601-1
    c. Subfleet C - J601-11
    d. Subfleet D - J601-9

IV. TONE REMOTE CONTROL ADAPTORS (Refer to page 3 of drawing).

A. Q1224 (T1/R1; for single fleet/subfleet operation).

1. Remove jumpers JU6, JU7, JU8 and JU10 on QLN4828 board.
    a. All other jumpers should be in.

2. Make external connections as shown on drawing.

B. Q1222 (T4/R4; for multiple subfleet operation).

1. Configure jumpers for the QLN4828 board as shown above.

2. Remove JU22 on QLN1716 board.
    a. All other jumpers left in.

3. Make external connections as shown on drawing.

IV. INTERCABLING (Refer to page 2 & 3 of drawing).

A. Interface Chassis to console.

1. Wire as shown on page 2 of drawing.

B. Remote Adapters to Radios

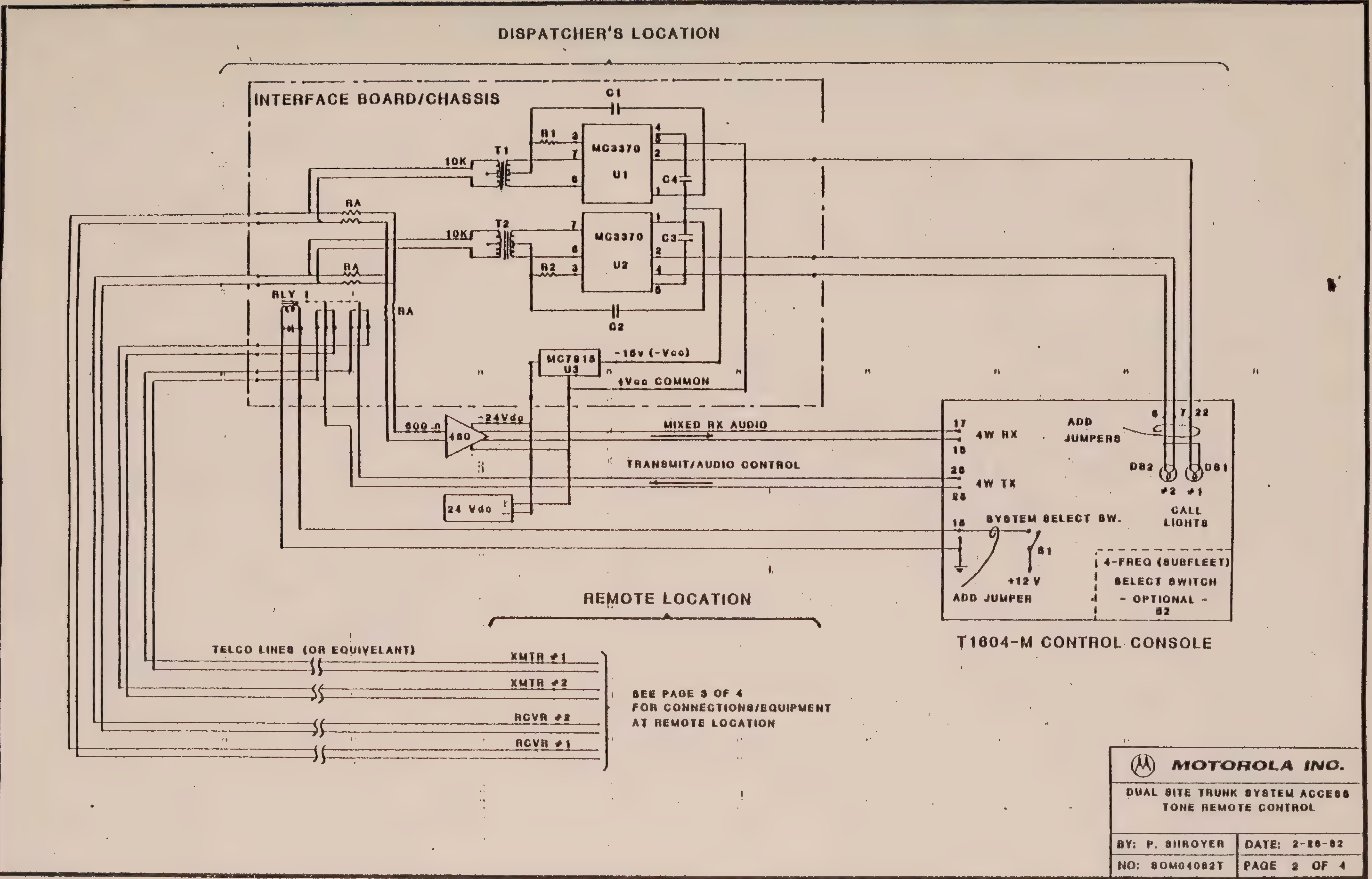
1. Make connections from TB1 to the P601 connectors (p/o MOTRAR power supply cables) as shown on page 3 of drawing.

   a. The lugs on the radio end of the multiconductor cables supplied will have to be removed. They will be replaced with the male terminal pins (supplied) that will be fitted into P601. Additional female pins (supplied) will also be required for J601.

C. Receive Audio

1. Mount the DO-T4 transformers (as shown on page 3 of the drawing) in a convenient location.

   a. Note: Installer may wish to mount each transformer inside the MOTRAR radio if there is enough space.

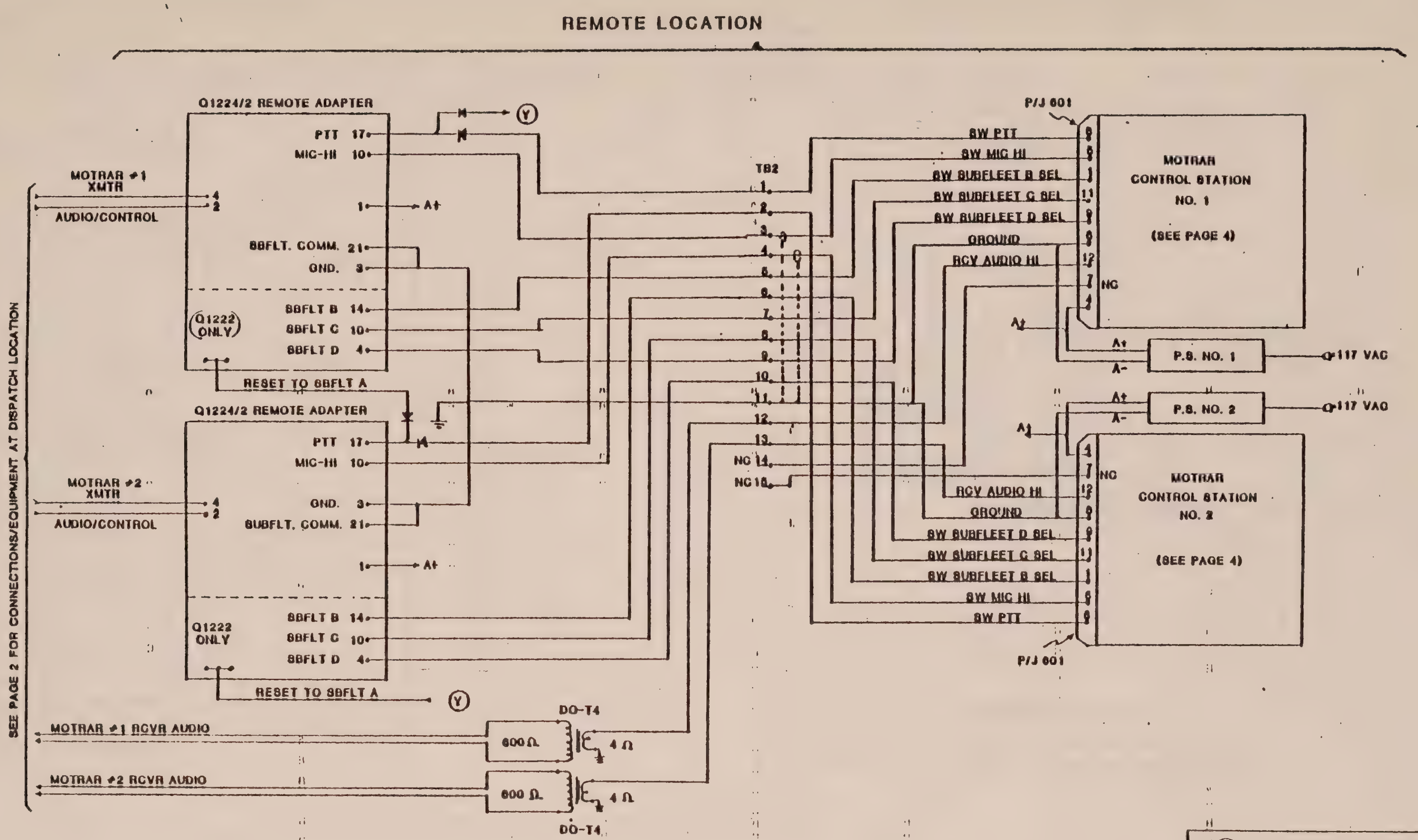


MOTOROLA INC.

DUAL SITE TRUNK SYSTEM ACCESS
TONE REMOTE CONTROL

BY: P. SHROYER	DATE: 2-26-82
NO: 80M04082T	PAGE 2 OF 4

3818-70(B)

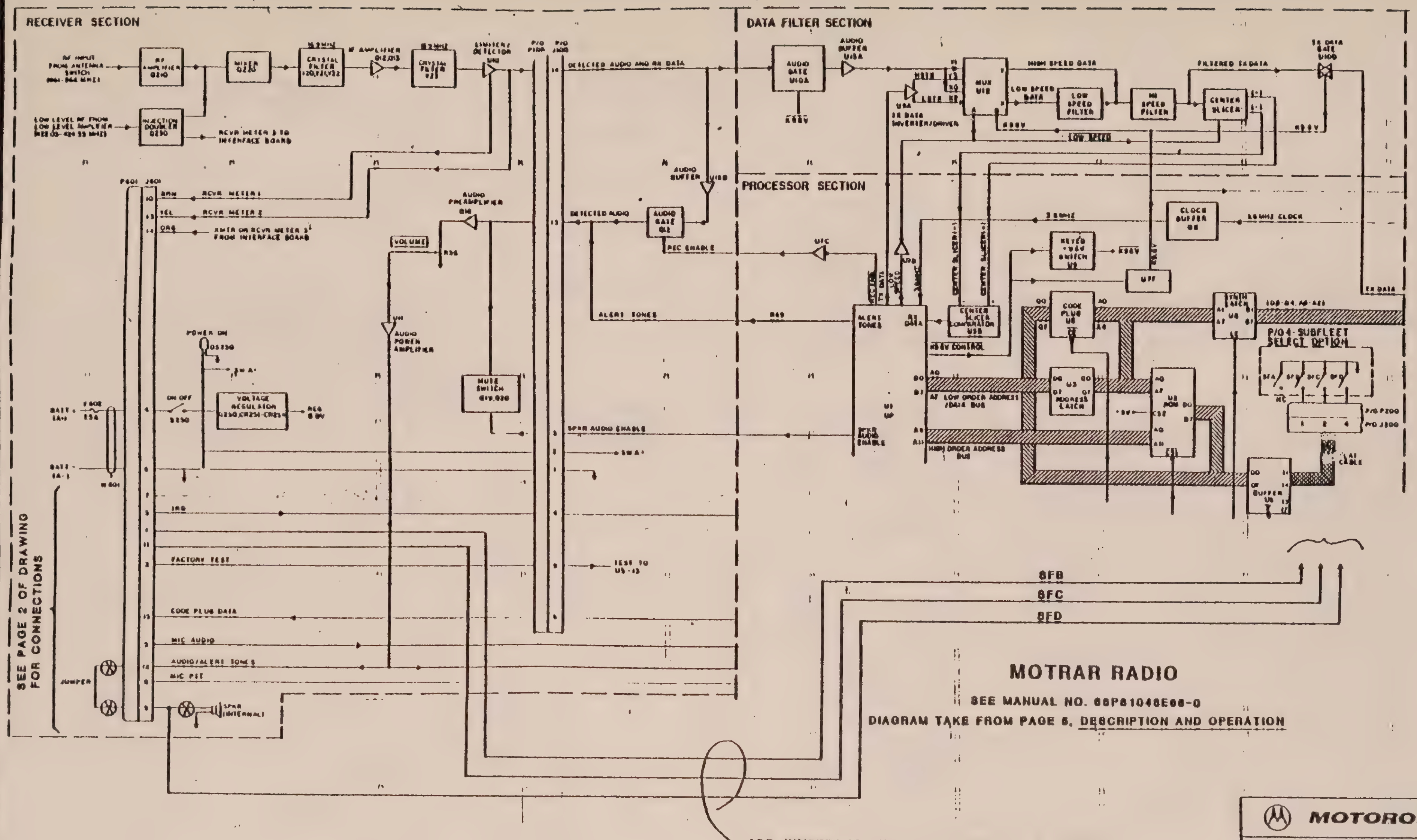


MOTOROLA INC.

DUAL-SITE TRUNK SYSTEM ACCESS
TONE REMOTE CONTROL

BY: P. SHROYER	DATE: 2-26-82
NO: 80M0482T	PAGE 3 OF 4

3818-70(B)



MOTRAR RADIO

SEE MANUAL NO. 68P81046E66-0

DIAGRAM TAKE FROM PAGE 6, DESCRIPTION AND OPERATION

ADD JUMPERS IF SELECTABLE SUBFLEET IS REQUIRED

NOTE: ⊗ INDICATES CUT

MOTOROLA INC.

DUAL-SITE TRUNKED SYSTEM ACCESS
MOTRAR RADIO MODIFICATIONS

BY: P. SHROYER	DATE: 4/20/82
NO: 80M0482-T	PAGE 4 OF 4

3818-70(B)

REV. 1

ORDERING INFORMATION

Device	Temperature Range	Package
MC3370P	−10°C to +75°C	Plastic DIP

MC3370P

ZERO VOLTAGE SWITCH

SILICON MONOLITHIC FUNCTIONAL CIRCUIT

P SUFFIX
PLASTIC PACKAGE
CASE 626

ZERO VOLTAGE SWITCH

. . . designed for use in ac power switching applications with output drive capable of triggering triacs. Other operational features include: (1) a built-in voltage regulator that allows direct ac line operation, (2) a differential input with dual sensor inputs capable of testing the condition of two external sensors and controlling the gate pulse to a triac accordingly; (hysteresis or proportional control to this section may be added if desired) (3) sensor input "open and short" protection, this insures that the triac will never be turned "on" if either of the inputs are shorted or opened (4) a zero crossing detector that synchronizes the triac gate pulses with the zero crossing of the ac line voltage. This eliminates radio frequency interference (RFI) when used with resistive loads.

- Heater Controls
- Photo Controls
- Threshold Detector
- Lamp Driver
- Valve Control
- On-Off Power Controls
- Relay Driver
- Flasher Control
- Formerly MFC8070 in Case 644A Package

FIGURE 1 – CIRCUIT SCHEMATIC

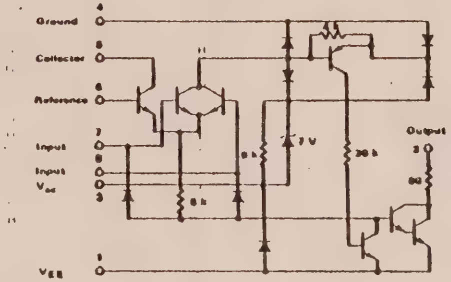
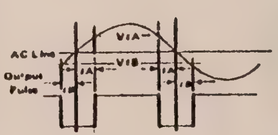


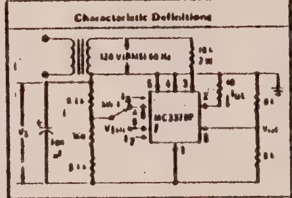
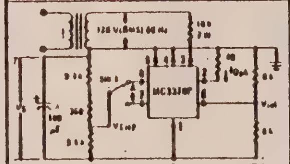
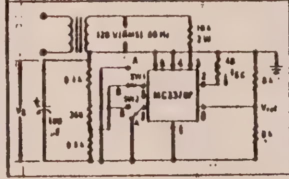
FIGURE 2 – OUTPUT PULSE DEFINITION



MAXIMUM RATINGS ($T_A = +25°C$ unless otherwise noted.)

Rating	Symbol	Value	Unit
DC Voltage	$V_{4\text{-}1}$	15	Vdc
DC Voltage	$V_{6\text{-}1}$	15	Vdc
DC Voltage	$V_{2\text{-}1}$	15	Vdc
Peak Supply Current	I_3	35	mA
Power Dissipation Derate above $T_A = +25°C$	P_D $1/R_{\theta JA}$	1.2 10	Watts mW/°C
Operating Ambient Temperature Range	T_A	−10 to +75	°C
Storage Temperature Range	T_{stg}	−55 to +150	°C

ELECTRICAL CHARACTERISTICS ($T_A = +25°C$ unless otherwise noted.)

Characteristic Definitions	Characteristic	Symbol	Min	Typ	Max	Unit
	V_S with Inhibit Output (Sw 1: A or B)	V_{SIO}	–	9.0	11	Vdc
	Output Leakage Current (Sw 1: A or B)	I_{OL}	–	5.0	100	µA
	Input Current 8 (Sw 1: A)	I_8	–	6.0	15	µA
	Input Current 7 (Sw 1: B)	I_7	–	6.0	15	µA
	Inhibit Threshold Voltage (Sw 1: A or B)	V_{THI}	V_{ref} +100 mV	V_{ref} +10 mV	–	Vdc
	V_S with Pulse Output (Sw 1: A or B)	V_{SPO}	6.0	8.5	–	Vdc
	Peak Output Current (Sw 1: A or B)	I_{Opk}	50	80	–	mA
	Pulse Threshold Voltage (Sw 1: A or B)	V_{THP}	–	V_{ref} −10 mV	V_{ref} −100 mV	Vdc
	Output Pulse Width (Sw 1: A or B, See Figure 2)	tA, tB VtA, VtB	–	70 ±4.0	– –	µs V
	Output Current With Input Short (Sw 1: B; Sw 2: A) (Sw 1: A; Sw 2: B)	I_{SC}	 – –	 6.0 8.0	 100 100	µA

SERVICE AND REPAIR NOTES
bulletin

MOTOROLA
COMMUNICATIONS AND ELECTRONICS, INC.
A SUBSIDIARY OF MOTOROLA, INC.

• 1301 E. ALGONQUIN RD. • SCHAUMBURG, ILL. 60196 •

EPD-21007-B

ROUTING

______
______
______

SRN-950
March 1982
APC-243
Deadline Date: N/A

TRUNKED MOBILE "SYNTOR X QUIK-CALL II" MODIFICATION FOR INDIVIDUAL CALL OPTION

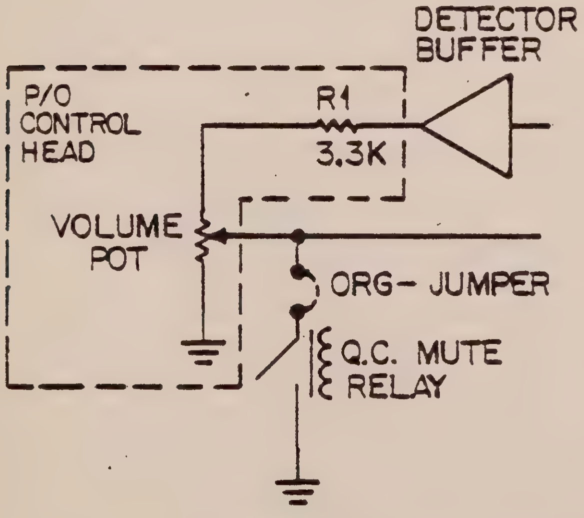
MODELS AFFECTED: T45VBJ5G00AK Trunked "SYNTOR X" Mobile
T45VSJ5900AK Trunked "SYNTOR X2" Mobile

The Trunked "Quik-Call II" Option W562 or W563 as shipped from factory is wired for paging mode only. Paging tones are received and an audible alert tone is sounded when the correct tones are received. Horn and lights can also be activated. No private calls to individual vehicles can be made in a trunked system. However, individual call capability can be allowed by making field wiring changes at the time of installation.

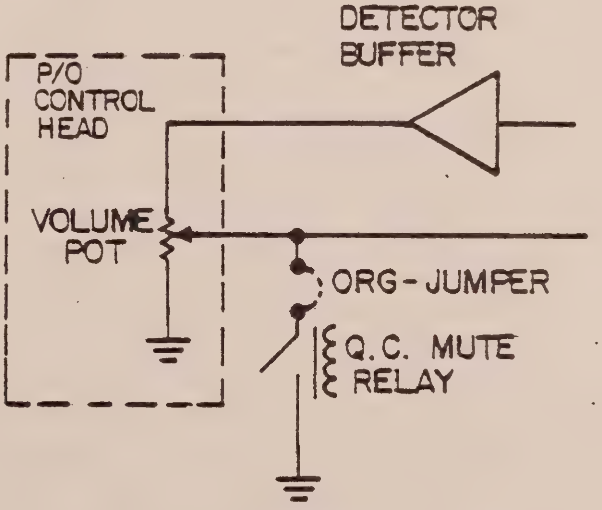
Background Information:

The conventional "Quik-Call II" unit mutes the receive audio by shorting the wiper of the volume control to ground via a set of relay contacts. When a call is received with the correct signalling tones, the contacts are opened and the call is heard. The relay contacts are connected to the volume control wiper via an ORG jumper wire normally connected between pin 22 and 4 of the green connector P1.

Refer to the following diagrams.



CONVENTIONAL RADIO



TRUNKED RADIO

(OVER)

In a conventional radio, under full volume, muted conditions, the output of the detector buffer is shorted to ground through resistor R1, 3.3K. In a trunked radio, under the same conditions, the detector buffer is shorted directly to ground. Damage could result! If the radio is modified for individual call, a 3.3K resistor must be inserted in series with the top of the pot inside the control head.

One additional change must be made for individual call capability. Since no hang-up box is supplied with trunked "Quik-Call II", it must be provided.

Modification Procedure To Add Individual Call Capability To a Radio Equipped With Trunked "Quik-Call II" Option:

A. Parts Required:
1. Hang-up box TLN5181A or HLN4188A.
2. 3.3K Resistor 0611009C61 or 0600124A61.

B. Hang-Up Box Installation:
1. Remove the black-violet wire from the green connector P1-19. Insert the green lead from the hang-up box into P1-19.
2. Cut the black-violet wire, coming from P1-2, approximately 1 inch from the green connector. This will allow the black-violet wire to be removed from the cable kit and set aside.
3. Splice the black wire from the hang-up box to the 1 inch black-violet wire from P1-2, (the lug on the black wire must be removed to do this).

Mute Circuit Installation:

1. Remove the "Quik-Call II" circuit board from its housing and solder a jumper wire from J1-22 to J1-4. A piece of the previously removed black-violet wire can be used. Alternately, a connector pin can be put on the end of the removed black-violet wire. The wire can then be plugged into the green connector between pins 4 and 22.

2A. For "SYNTOR X2" Radios: Open the control head housing and cut the wire lead going to the top of the volume pot. This lead runs to the PC board from the pot and connects to J1101-16. Across this cut, solder a 3.3K 1/4 W resistor.

2B. For "SYNTOR X" Radios: Remove the main control head PC board from the housing. Cut the PC runner connecting the top of the volume pot to pin 16 of J1101, the black connector. Solder a 3.3K resistor across these same points.

3. Reassemble the control head and the "Quik-Call II" decoder. On radios equipped with the handset option, the hang-up box is included with the handset. However, the wires from the hang-up box have been cut flush with the end of the connecting cable. These wires must be extended before they can be connected to the green connector block.

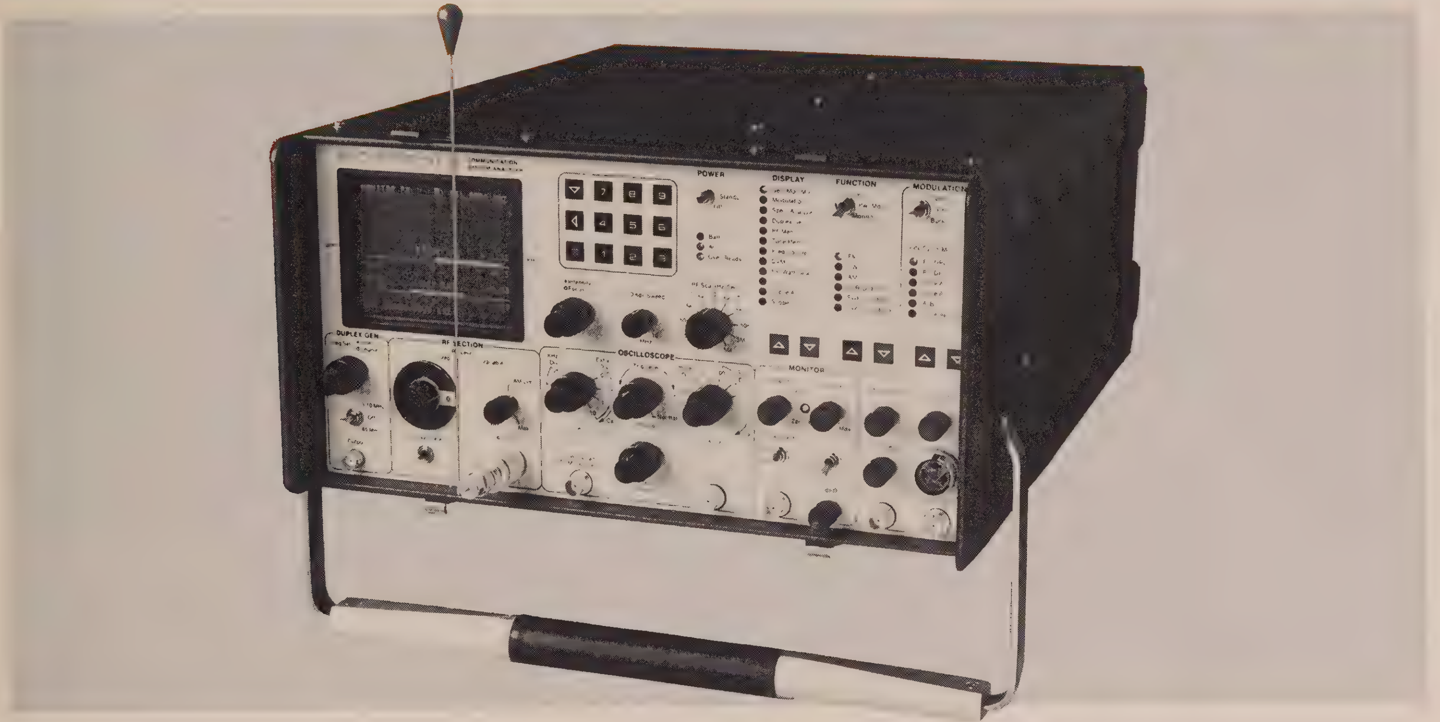
TEST

EQUIPMENT

R3 9 51

MOTOROLA

Communications System Analyzer R-2001A Series



The Motorola Communications System Analyzer is a versatile, rugged, compact, and portable test instrument, designed specifically for the service and monitoring of communications equipment. Its functions supersede those of a Service Monitor, expanding the features and capabilities to the point where a new era in servicing is afforded with a single instrument, rather than a host of separate equipment.

The Motorola Communications System Analyzer is designed to improve a technician's efficiency and accuracy. Consequently, the cost of servicing can be reduced since the Communications System Analyzer performs functions that require many separate instruments. Servicing can be done faster because less time is spent hooking up equipment for testing, let alone the time a technician spends just transporting equipment to and from a field installation. The Communications System Analyzer was designed and built by Motorola, a result of our years of leadership experience in the land-mobile radio field.

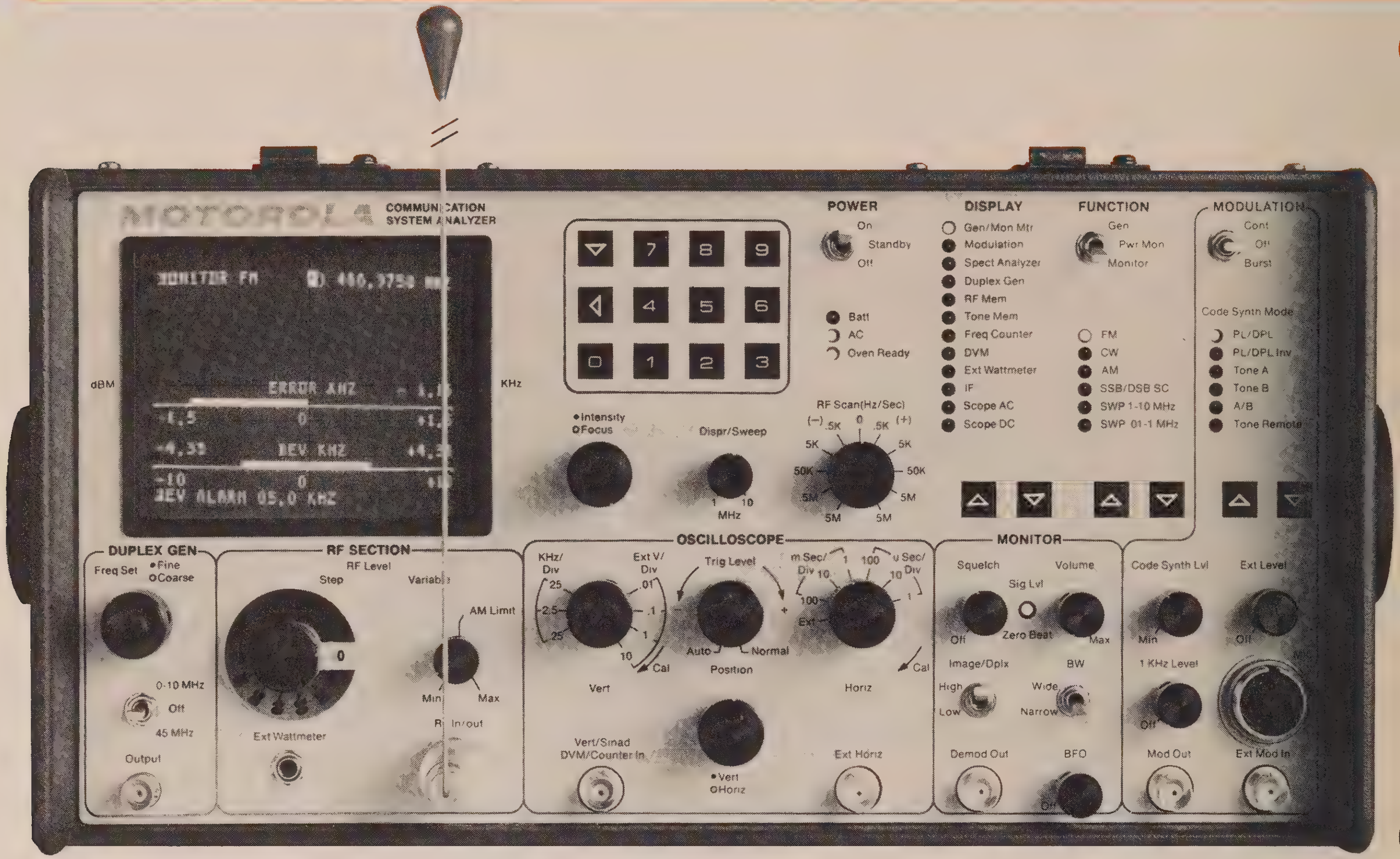
Not only does the Communications System Analyzer perform the functions of signal generation, frequency error and deviation measurement, but it is also capable of a variety of tests normally associated with these devices:

- Spectrum Analyzer
- Duplex Offset Generator
- Modulation Oscilloscope
- Frequency Counter
- AC/DC Digital-Analog Voltmeter
- RF Wattmeter
- General Purpose Oscilloscope
- Multi-Mode Code Synthesizer
- SINAD Meter
- Sweep Generator

All functions, generated or monitored, are presented in one area, on one display, rather than several areas of the instrument or on different instruments. The large, clear 8 cm x 10 cm cathode ray tube (CRT) display presents pertinent data in both analog and digital formats. There is no longer any guesswork when reading a meter face or looking at a generator dial. The presentation not only shows you the desired information, but also tells you exactly what function is being displayed. There is no need to look at function selectors either, as the display tells you how the various control switches are set.

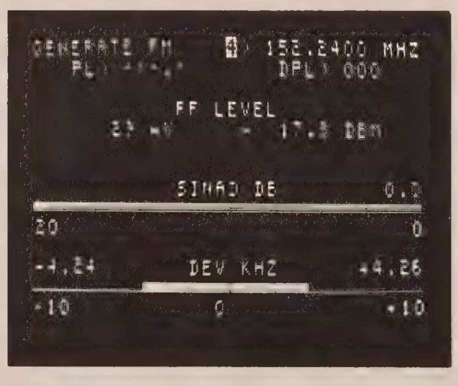
At the heart of the Communications System Analyzer's operation is a Motorola M-6800 series microprocessor. The use of this device permits keyboard entry of data, autoranging of displays, fast frequency access, permanent storage of often used frequencies and codes, as well as the reliable, rugged operation that is a must in the field service environment.

A New Era In Land-Mobile Service Instrumentatio



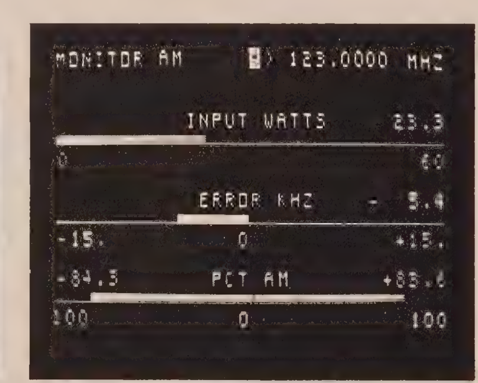
The front panel of the Communications System Analyzer is human engineered for ease of operation. All controls associated with a function are grouped together and each area of the panel is clearly labeled. As each control is manipulated, the display CRT immediately registers the change. The array of displays shown are just a few of the over thirty available for servicing communications equipment.

Sample Displays



```
GENERATE FM      4) 152.2400 MHZ
   PL) [illegible]        DPL) 000

           RF LEVEL
   2? mV      -  17.3 DBM

           SINAD DB          0.0
20                             0
-4.24      DEV KHZ         +4.26
-10           0              +10
```

Generate FM — When generating an FM signal, the carrier frequency is indicated, with the Private Line (PL) or Digital Private Line (DPL) code, when applicable. The RF level in Volts, plus the corresponding dBm value, are displayed. SINAD and Deviation are displayed numerically and by an intensified analog line segment, similar to a horizontal bar graph. Each line segment varies continuously based on the signal being generated.



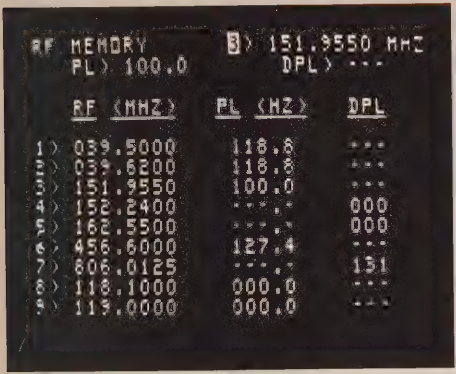
```
MONITOR AM       ▯) 123.0000 MHZ

            INPUT WATTS      23.3
0                              60
            ERROR KHZ    -    5.4
-15.           0             +15.
-84.3       PCT AM          +83.6
100            0              100
```

Power Monitor AM — Here an AM transmitter is connected directly into the RF input of the Communications System Analyzer, with frequency in, power in, frequency error and percentage of AM modulation displayed. Each line segment varies according to the input, as do the equivalent numerical indications. As the full-scale range of a display is exceeded, it auto-ranges to track the measured values, bringing them into proper perspective.

Spectrum Analysis — The Spectrum Analyzer display shows a window of the RF spectrum, varying in width from 1 MHz to 10 MHz, dependent upon the dispersion setting on the front panel. Center frequency of the signal is indicated to an accuracy of 100 Hz.

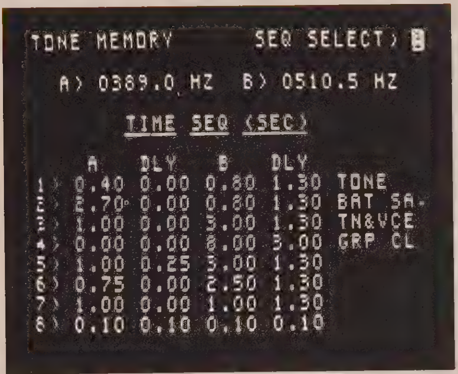
he Communications System Analyzer

Sample Displays



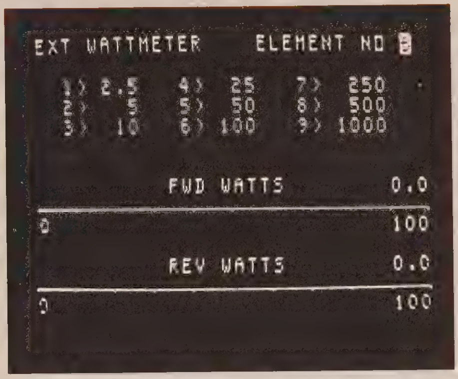
```
RF MEMORY          3> 151.9550 MHZ
   PL> 100.0          DPL> ---

   RF (MHZ)     PL (HZ)     DPL

1> 039.5000      118.8      ---
2> 039.6200      118.8      ---
3> 151.9550      100.0      ---
4> 152.2400      ---.-      000
5> 162.5500      ---.-      000
6> 456.6000      127.4      ---
7> 806.0125      ---.-      131
8> 118.1000      000.0      ---
9> 119.0000      000.0      ---
```

RF Memory Table — Often used frequencies are stored in the RF Memory, accompanied by associated "Private Line" and "Digital Private Line" codes. Each is cursor selected for monitoring or generating. The user programmable table is part of the non-volatile memory, and remains intact even when the instrument is turned off or unplugged.



```
TONE MEMORY          SEQ SELECT> 8

   A> 0389.0 HZ   B> 0510.5 HZ

        TIME SEQ (SEC)

     A    DLY    B    DLY
1> 0.40 0.00 0.80 1.30 TONE
2> 2.70 0.00 0.80 1.30 BAT SA.
3> 1.00 0.00 3.00 1.30 TN&VCE
4> 0.00 0.00 8.00 3.00 GRP CL
5> 1.00 0.25 3.00 1.30
6> 0.75 0.00 2.50 1.30
7> 1.00 0.00 1.00 1.30
8> 0.10 0.10 0.10 0.10
```

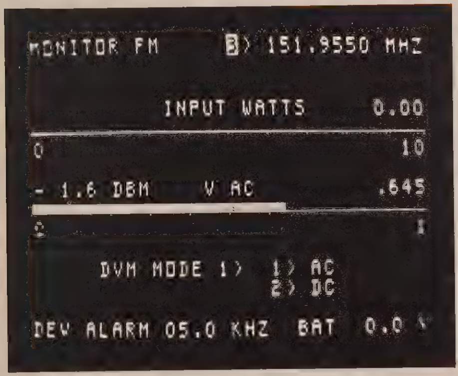
Tone Memory Table — The Tone Memory Table stores timing sequences and operates like the RF Memory. The first 4 sequences in the table are pre-programmed, non-changeable standards for use on a wide variety of Motorola and other manufacturer's equipment. The remaining sequences can be user programmed based on specific requirements. Sequences are cursor selected, as are the tone frequencies.



```
EXT WATTMETER     ELEMENT NO 8

  1> 2.5    4>  25    7>  250
  2>   5    5>  50    8>  500
  3>  10    6> 100    9> 1000

            FWD WATTS         0.0
0                             100

            REV WATTS         0.0
0                             100
```

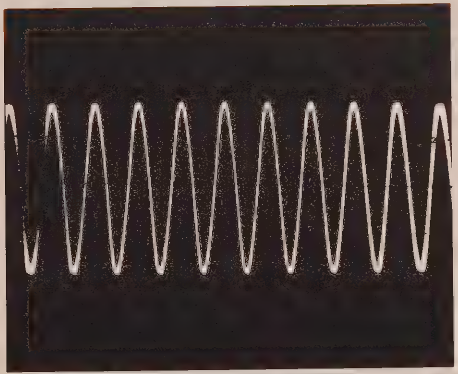
In-Line Power Measuring — By using Motorola's ST-1200 series Wattmeter elements, the Communications System Analyzer measures forward and reflected power from a transmitter. The correct range for the system under test is cursor selected. Power is shown by analog line segments and the digital readout to the right of each line.

Sample Displays

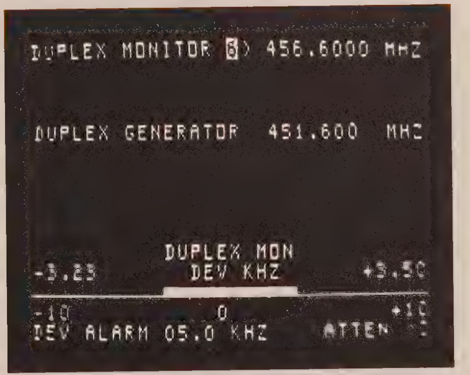


```
MONITOR FM        3> 151.9550 MHZ

          INPUT WATTS         0.00
0                               10
- 1.6 DBM      V AC           .645
0                                1

       DVM MODE 1>   1> AC
                     2> DC

DEV ALARM 05.0 KHZ   BAT     0.0 V
```

Digital Volt Meter — Selecting the Digital Volt Meter (DVM) enables the Voltage metering capabilities of the Communications System Analyzer. AC or DC mode is selected by the cursor. The analog line segment and digital readout indicate the voltages measured. The auto-ranging display measures 1, 10, 100 or 300 Volts full scale. Optional Battery Pack voltage is also shown on the DVM display.



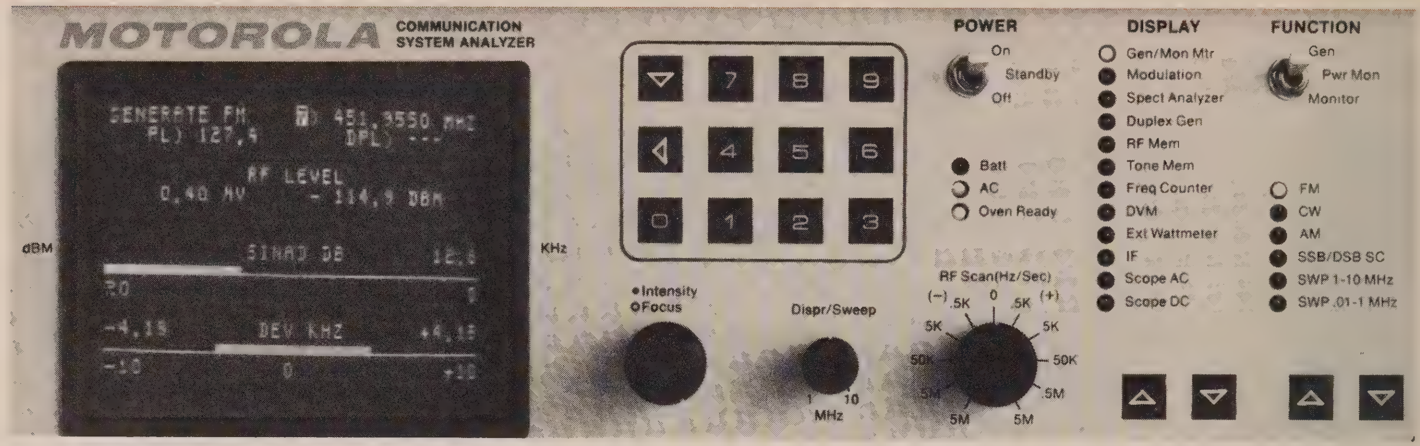
General Purpose Oscilloscope — The general purpose Oscilloscope display is AC or DC coupled, as determined by the display selector. Internal or external inputs allow observation of both generated and monitored modulation signals. An additional benefit of the scope is the IF mode, which displays the modulation envelope of the instrument's IF amplifier.



```
DUPLEX MONITOR 6> 456.6000 MHZ


DUPLEX GENERATOR  451.600  MHZ



            DUPLEX MON
-3.23        DEV KHZ         +3.50
-10             0              +10
DEV ALARM 05.0 KHZ      ATTEN
```

Duplex Generator — The Duplex generate mode enables this display. It shows the monitored and generated frequencies, deviations and deviation alarm limit. Frequency offset is adjustable from 0 to ±10 MHz, or can be set at ±45 MHz when servicing 800 MHz transceivers.

Communications System Analyzer



Cathode Ray Tube and Controls, Power, Display Mode and Function

Features ● Benefits

General

Motorola Microprocessor — The Motorola M-6800 series microprocessor is used in diversified applications throughout the electronics industry. In the Communications System Analyzer, its use permits extraordinary variety in service applications, through presentation of all generated and measured parameters in one integrated, digital-analog, auto-ranging CRT display. ● It formats data, provides fast frequency access and controls memory storage and recall, thus offering the two-way land mobile service community a single instrument capable of performing the functions of a service monitor as well as those of many other pieces of test equipment.

Field Environment Tough — Each component that goes into the Communications System Analyzer is thoroughly inspected to ensure high reliability. Careful mechanical design allows the instrument to pass stringent tests for vibration and shock. It meets the shock and vibration portions of EIA test RS152B, the same specifications met by Motorola mobile radios. ● This minimizes failures when the instrument is used in a mobile service van, and means it is as tough as the radios it services. And at the site, front panel components are protected from impact by bezel extensions on each side of the cabinet.

Human Engineered — The comfortable handle, coupled to the size and weight of the Communications System Analyzer, enables easy carrying. While the unit is rugged, it's easy to transport, not just in a van, but also by hand. ● The position of the handle lets the unit "hang" naturally, close to the body, so it's just like carrying a suitcase.

Single Information Display — The large, clear 8 cm x 10 cm CRT presentation provides all information in a continuously auto-ranging digital-analog display of selected parameters. ● Instead of looking at different instruments, or searching the panel of the instrument for settings, the technician need only go to one point on the Communications System Analyzer for information.

Programmable, Non-Volatile Memory — Generated and monitored RF frequencies, tone codes and timing sequences can be programmed to save time and eliminate entry errors. Most commonly used frequencies are stored in the RF and TONE memories for immediate user access. The Communications System Analyzer can also be programmed to a predetermined mode of operation when first turned on. ● This is especially time saving when the instrument is continuously used to service one particular type of equipment. These programming functions are all non-volatile, i.e., when the instrument is turned off after use, they remain in the memory.

AM, FM, CW, DSB Signal Generator — The built-in general purpose signal generator provides continuous coverage of the HF, VHF, and UHF land mobile spectrum for receiver testing. With this feature, many forms of external and internal modulation can be simultaneously impressed on the carrier frequency for actual composite signals. The frequency range of the RF signal generator is from 10 kHz up to 1000 MHz, in 100 Hz steps. ● Receiver testing time is reduced as less time is spent on "hook-up" and less equipment is needed.

Modular Construction — The Communications System Analyzer is designed to be serviced quickly and easily, should a breakdown occur. The majority of the circuitry is on seven modular plug-in circuit boards which have built-in metering and test points that aid in isolating the problem to a specific board. ● Once the board is located, simple plug-in replacement gets the instrument back in service.

System Warnings — To further aid the technician in servicing, visual warnings will appear on the CRT when certain overload or caution conditions exist. Displays warn of low battery power, overheating of the RF load, or an improper attenuator setting for particular measurements.

In addition, a continuous audible tone sounds when a preset deviation limit is exceeded in monitor modes. This limit is entered by using the keyboard and may be programmed from 0 kHz to 99.9 kHz, with 100 Hz resolution. ● These built-in warnings are designed to aid the technician in obtaining accurate readings and to prevent damage to the instrument.

Wide Range — All of the Communications System Analyzer functions operate up to 1 GHz, which includes the new 800 MHz bands, a major growth area in land-mobile two-way communications. And for receiver or transmitter measurements, there is just one RF hookup to the instrument. ● It thus provides state-of-the-art servicing for state-of-the-art communications equipment.

Features ● Benefits

Displays and Functions

Bright, Clear CRT Presentation—Modes of operation are indicated in large characters on the display, so there is never a question of what is being measured. Digital readouts are visually aided by the use of the continuously auto-ranging analog line segments, which are similar to a bar graph. Each has a base line and calibration markers, in addition to the intensified segment showing the measurement. ● All measurement parameters are crisply displayed on the large, clear CRT (8 cm x 10 cm), allowing instant recognition of measurement results and generated signal information.

Keyboard Entry — Numbered keys are used for entering data, such as frequencies and codes. Arrow keys are used to step the cursor horizontally or vertically, and to select some operating functions. ● The keyboard is easy to operate and helps to minimize errors by providing fast, precise settings.

Versatile Power Supply — The Communications System Analyzer may be powered by a variety of sources: AC at 110 or 220 Volts, 50/60 Hz; DC from an external 12 Volt source such as a service vehicle; DC from an optional battery pack. ● Servicing can thus be accomplished wherever the equipment under test is located.

Display Control/LED Indicators — The user selectable displays are listed in a column beneath the DISPLAY heading on the front panel. Choosing a display is accomplished by pressing an arrow button below the column, for up or down movement, as required. When the appropriate arrow is pressed, the LED adjacent to the selected display illuminates. ● Its bright glow eliminates any question of which operating mode and accompanying display have been chosen. FUNCTION is selected in the same way, providing rapid, accurate changes in service capability at the touch of a button.

AM, FM, and Sideband Modulation and Measurement — With the Communications System Analyzer's capabilities, all of the following radio types may be serviced: FM two-way radios and paging systems, citizens band, AM transceivers and pagers, high frequency SSB including marine, amateur and military equipment, and most types of AM, FM or SSB transmitters and receivers operating between 1 MHz and 1 GHz. ● It provides the utmost in versatility and cost effectiveness with the convenience of just one test instrument.

SINAD Metering — As a comprehensive check of receiver performance, the SINAD measurement is unmatched. The analog line segment and digital representation of SINAD appear automatically whenever the unit is in the normal generate mode. The only hookups required are from the Communications System Analyzer to the RF input of the receiver under test, and from the audio output of the receiver to the instrument's multi-purpose input. ● The measurement, and appropriate servicing, can then be accomplished without the need for a separate signal generator, SINAD meter or distortion analyzer.

Terminated RF Power Measurement — RF power is automatically measured when the Communications System Analyzer is in the Power-Monitor mode. The built-in dummy load dissipates up to 50 watts for three minutes and up to 125 watts for one minute. If a high power transmitter should be keyed into the unit for any longer, the CRT display changes to read "RF LOAD OVER-TEMP," thus warning the technician to un-key. ● This instrument function is further enhanced by the simultaneous indication of RF power output, carrier frequency error, and modulation, all on the same CRT display.

Spectrum Analyzer (Built-In) — In this mode of operation the CRT displays a window of the RF spectrum whose bandwidth (from 1 MHz to 10 MHz) is determined by the DISPERSION/SWEEP control. The center frequency of this window ranges from 2 MHz to 1,000 MHz, selectable by entering a specific center frequency with the keyboard. This center frequency, accurate to 100 Hz, is digitally displayed at the top of the CRT screen, eliminating the need for an external signal generator, and counter to provide markers. Once a signal is centered on the screen, positive identification is aided by switching the Analyzer to MONITOR AM or FM and listening to the demodulated output via the built-in audio amplifier and speaker.

The spectrum can be scanned up or down at rates varying from 0.5 kHz per second to 5 MHz per second, using the RF scan control. Slow rates are used to precisely determine a subject signal's frequency while faster rates are used for locating intermittent transmissions or viewing large areas of the spectrum in a short time.

● Other benefits derived by use of the Spectrum Analyzer are: Intermodulation interference identification, IF and RF signal tracing, transmitter harmonics measurement, and checking for spurious outputs from transmitters or receiver local oscillator radiation.

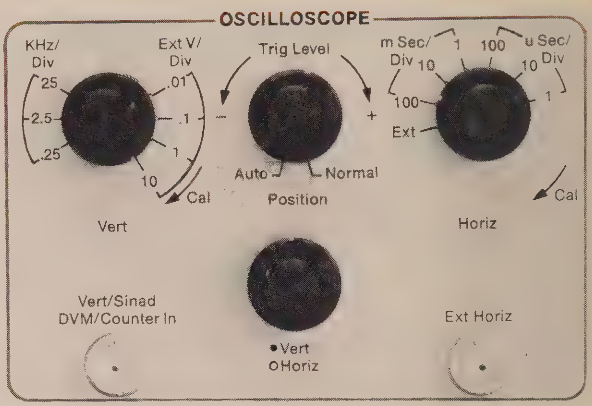
Frequency Counter — The frequency counter measures inputs in a range from 10 Hz to 35 MHz. Its 5 digit auto-ranging output is displayed on the CRT and allows precise measurement and setting of offset oscillators, 35 kHz and 455 kHz pager IF's, PL frequencies and other external input signals. This function will also operate simultaneously with the generate or monitor receiver modes of operation.

AC/DC Voltmeter — Switching to the DVM mode provides a digital-analog voltage presentation on the CRT, along with the corresponding dBm value. The auto-ranging display provides full scale deflections of 1, 10, 100 and 300 Volts, with 1% of full scale accuracy in the DC mode and 5% of full scale accuracy in AC. AC or DC measurement is selected by using the cursor. ● The meter's wide dynamic range and three digit display are ideal for setting power supply voltages, checking bias levels, and setting audio levels. Like the Frequency Counter, the DVM will operate simultaneously with generate or monitor operation, if selected.

Communications System Analyzer

Features ● Benefits

Analyzer Sections



General Purpose Oscilloscope

Modulation Control, Input and Output

Multi-Mode Code Synthesizer — The Communications System Analyzer generates Private Line tones (PL), Digital Private Line codes (DPL), two-tone sequential paging codes and tone-remote base signaling tones, all of which are available at the Modulation Output jack, as well as being used internally to modulate signals. ● This eliminates the necessity of using separate generators and oscillators for general servicing, setting transmitter deviation or checking tone-remote-base control lines. Timing sequences are also stored in the Tone Memory to provide fast set-up and eliminate errors. User programmable timing sequences are also provided to allow the storage of non-standard or future time sequences.

Simultaneous Modulation — In addition to the Code Synthesizer, modulation is also simultaneously available from an independently adjustable internal 1 KHz tone generator as well as from external inputs. The external modulation can be voice from a standard mobile radio microphone (which plugs into the front panel of the instrument), as well as a signal applied to the external BNC input. Separate controls are provided for independently setting the levels of the Code Synthesizer, 1 KHz tone and external modulation sources. ● This provides composite signals for testing Private Line systems with actual voice or test tone modulation. The 1 KHz test tone is also a convenient source of modulation for making SINAD measurements. A MOD OUT connector provides external access to all of the modulation signals.

Monitoring Controls

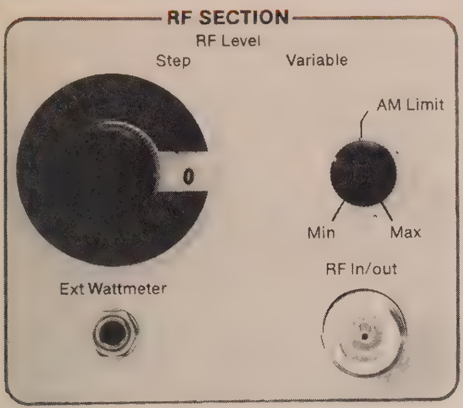
1.5 μV — Off-The-Air Sensitivity — The sensitivity of the Communications System Analyzer receiver allows off-the-air monitoring and measurement of transmitter frequency error and deviation to 1000 MHz. Variable squelch aids in picking up weak signals for off-the-air monitoring, but can be set higher to ensure the proper signal-to-noise ratio for measurement accuracy. ● This enables frequent parameter checks without leaving the shop, thus spotting system degradation early and keeping service costs down. Bandwidth can be set at Wide for off-channel signal location or wide band FM; or Narrow for maximum sensitivity and selectivity.

500 kHz Oscilloscope — This general purpose scope is ideal for waveform analysis in two-way communication servicing. ● Use it for viewing modulation signals (either internally or externally generated), detection of asymmetric modulation or audio distortion.

Sweep Generation — Through use of the Sweep Generator, bandpass characteristics can be determined. ● This is ideal for in-depth trouble shooting of IF amplifiers, filters, and FM demodulators.

IF Display — When the IF display mode is selected, the Communications System Analyzer's receiver IF envelope is shown on the CRT. ● This array allows the technician to qualitatively and quantitatively assess the amplitude modulation envelope of a transmitted carrier frequency.

Modulation Display — In this mode of operation, the recovered audio waveform, or audio used to modulate the Generator carrier, appears on the CRT. ● It is used to graphically measure deviation, and aid in waveform analysis.



RF Section

High Level Calibrated RF Output — The output of up to 1 Volt provides sufficient amplitude to get through misaligned tuners and receivers, and is especially effective when changing receiver frequency. ● The high level, clean output is available over the entire frequency range of the Communications System Analyzer.

RF Burnout Protection — At RF levels above 200 mW, in any operating mode, the input automatically switches to the internal 125 watt RF load, ● thus protecting the attenuator and signal generator from damage from a keyed transmitter.

Low RF Leakage — RF spray protection allows servicing of pagers, portables and other sensitive equipment with built-in antennas. The Communications System Analyzer is also shielded against high levels of external RF energy, ● enhancing accurate operation in adverse on-site locations.

In-Line Power Measurement — Use of Motorola ST-1200 series Wattmeter elements in conjunction with the System Analyzer provides measurement of forward and reflected antenna power on the CRT display ● without a complex hook-up or use of additional instruments.

WWV Self Calibration—By using a special high resolution analog-digital monitor scale on the CRT, the Communications System Analyzer's time base can be calibrated to 0.5 PPM. ● Just tune in the HF WWV signal and adjust the time base oscillator to null the error.

Duplex Generator

Duplex Generator — In this mode, the Communications System Analyzer simultaneously receives and generates the proper signals for duplex radio servicing, while generated and monitored frequencies are observed on the CRT. In the 0-10 MHz range, the 'Freq. Set' control determines proper offset frequencies for VHF and UHF bands. The 45 MHz mode provides a single offset for the 800 MHz range, and a switch is also provided to select high or low side offset, as required. ● The Duplex Generator provides enhanced capability to service equipment such as repeaters, car telephones and Emergency Medical Telemetry portables.

Accessories Supplied

Front Cover — Front panel components and the CRT are protected from the elements during transit, or while the instrument is not in use, by the front cover. Ample room is provided for storage of cables, power cord, and other equipment needed for on-site servicing. Supplied with instrument.

Sun Shade — Simply snap on over the CRT to observe selected displays, even in bright sunlight. Supplied with instrument.

Antenna — A BNC connected antenna is provided for convenience in receiving off-the-air signals. When not in use, it stores neatly in the front cover. Supplied with instrument.

Power Cord — The three-conductor cord is supplied for powering System Analyzer by AC, and for use when charging the optional battery pack. Its right angle design allows the unit to stand on end. Supplied with instrument.

Oscilloscope Probe — A x 1 oscilloscope probe, with attachments, is provided for general servicing needs.

Manual — An owner/operator manual includes all instructions necessary for proper utilization of the Communications System Analyzer. Supplied with instrument.

Options

IEEE-488 Standard Interface Bus — The Communications System Analyzer is compatible with the IEEE-488 Interface Bus, to enable fully automated testing with the instrument. Contact your Area Office or Test Equipment Consultant for detailed information. Order R-2002A series. See Model Nomenclature in Specifications.

Blower — The optional blower (recommended equipment with the IEEE-488 Interface option) provides additional cooling in excessively high ambient temperature conditions, ensuring reliable, stable operation of all functions. Can be field installed. Order No. RTL-4054A.

Battery Pack — A 13.6 Volt battery attaches directly to the back of the unit, providing one hour of continuous operation. Built-in circuitry charges the battery when the power switch is in the "Off" or "Standby" position. When battery power falls below 12 Volts, a warning appears on the CRT display. Cannot be used in conjunction with IEEE-488 Interface Bus or Blower. Can be field installed. Order No. RTP-1002A.

High Stability Oscillator — Use of this oscillator improves stability over the standard TCXO time base to $\pm 5 \times 10^{-8}$ maximum error, over the temperature range of from 0 to 55°C. A front panel LED indicates when the ovenized crystal has stabilized. Order Model R-2001A/HS, R-2001A/HS/220, R-2002A/HS or R-2002A/HS/220 (See Model Nomenclature in Specifications)

In-Line Wattmeter Adapter — Allows use of Motorola ST-1200 series In-Line Wattmeter elements for direct measurement and display of forward and reflected transmitter power. Order No. RTL-4055A.

Protective Cover — A rugged, padded, fabric type cover to protect instrument from excessive field wear. Order No. RTL-4056A.

R-2001A Series Communications System Analyzer

Specifications

Operating/Display Modes:	AM/FM/CW/SSB Monitor, AM/FM/CW/DSBSC Generate, Code Synthesizer, Spectrum Analyzer, Duplex Generator, Memory Tables, Frequency Counter, Digital Volt Meter, Wattmeter, IF Display, Oscilloscope

Signal Generator Mode

Frequency

Range:	10 kHz to 999.9999 MHz
Resolution:	100 Hz
Accuracy:	Refer to accuracy of master oscillator

Output (Levelled into 50 ohms)

Attenuator:	16 dB variable plus 10 dB steps over 13 ranges
Range:	.1μV to 1 VRMS (−127 dBm to +13 dBm)
Accuracy:	±2 dB accuracy on .1 to 1 μV range ±2 dB across other step attenuator ranges ±1 dB over temperature range

Spectral Purity

Spurious:	≦ −40 dB
Harmonics:	≦ −15 dB

Frequency Modulation

Deviation:	0-50 kHz peak
FM Residual Noise:	100 Hz
External/Internal Frequency Range:	5 Hz to 10 kHz (±1 dB)
Modes:	Internal, external, microphone or all simultaneously

Amplitude Modulation

Range:	0 to 80% with ±10% full scale readout accuracy
External/Internal Frequency Range:	5 Hz-10 kHz (±1 dB)
External Input:	Approx. 150mV for 80%, BNC connector
Modes:	Internal, external, microphone or all simultaneously

Double Sideband Suppressed Carrier

Carrier Suppression:	≧25 dB (1 MHz-500 MHz)

Monitor Mode

Frequency Range:	1 MHz to 999.9999 MHz
Resolution:	100 Hz
Accuracy:	Equal to that of master oscillator time base
Frequency Error Indicator:	Autoranging CRT display. Accuracy ±10 Hz for frequency error measurements on 1.5 kHz, 5 kHz and 15 kHz full scale ranges 50 Hz full scale for time base calibration
Input Sensitivity:	1.5μV for 10 dB EIA Sinad (narrow band ±6 kHz mod. acceptance) 7μV for 10 dB EIA Sinad (wide band ±100 kHz mod. acceptance)
Spurious Response:	−40 dB typical 0 dB image at ±21.4 MHz −10 dB at L.O. harmonics ±10.7 MHz

Deviation Measurement

Range:	1, 10, 100 kHz full scale
Accuracy:	±5% of reading ±100 Hz from 500 Hz to 50 kHz deviation; ±10% of reading from 50 kHz to 75 kHz deviation
Peak Deviation Limit:	Set via keyboard to 100 Hz resolution (0 kHz to 99.9 kHz). Audible alarm indicates limit condition and will be active in all Monitor Modes

AM Modulation Measurement

Range:	0 to 100%
Accuracy:	±5% of full scale

Built-in RF Wattmeter (Autoranging display)

Frequency Range:	1 MHz to 1000 MHz
Power Range:	.2 watts to 125 watts
Accuracy:	±10%
Protection:	Over-temp indicator

General

Spectrum Analyzer

Dynamic Range:	≧75 dB, −105 dBm to +20 dBm range with attenuator
Frequency Range:	2 MHz to 1,000 MHz
Full Scale Frequency Dispersion:	Adjustable between 1 MHz and 10 MHz

Duplex Generator

Frequency Offset:	Adjustable from 0 to 10 MHz plus fixed frequency of 45 MHz (high or low side)
Modulation Level:	Adjustable from 0 to 20 kHz peak deviation

Oscilloscope

Size:	8 cm x 10 cm
Frequency Response:	DC to .5 MHz (3 dB point)
External Vertical Input Ranges:	10mV, 100mV, 1V, 10V (per division)
Sweep Rates:	1μs, 10μs, .1ms, 1ms, .01S, .1S (per division)
Sync:	Automatic or adjustable level triggering

5 Digit Autoranging Frequency Counter

Frequency Range:	10 Hz to 35 MHz
Input Sensitivity:	30mV from 10 Hz to 1 MHz 50mV from 1 MHz to 35 MHz

Digital Voltmeter

Readout:	Auto ranging 3½ digit display, 1, 10, 100, 300 Volts full scale. AC-dBm calibrated across 600 ohms.
DC Accuracy:	±1% of full scale ±1 least significant digit
AC Accuracy:	±5% of full scale
AC Bandwidth:	50 Hz to 10 kHz

Code Synthesizer

Frequency Range:	50 Hz to 9.9999 kHz
Resolution:	.1 Hz
Frequency Accuracy and Stability (with temperature):	.01%
Output Level:	0-3V RMS into a 600 ohm load

SINAD Meter

Input Level Range:	.5V to 10 VRMS
Sinad Accuracy:	±1 dB at 12 dB Sinad

Manual Frequency Scan

Step Size:	Switch Selectable: 100 Hz, 1 kHz, 10 kHz, 100 kHz and 1 MHz (+ or −)
Step Rate:	5 steps/sec.

Time Base

Standard TCXO:	Aging: ±1 x 10^{-6} per year Temp: ±1 x 10^{-6} maximum error over the 0° to 55°C temp. range
Optional Ovenized High Stability:	Aging: ±1 x 10^{-6} per year Temp: ±5 x 10^{-8} maximum error over the 0° to 55°C temp. range (warmup to ±5 x 10^{-7} of final frequency within 20 minutes)

Power and Environmental

AC:	100-130 VAC, 200-260 VAC 47-63 Hz
DC:	+11.5 VDC to +16 VDC
Optional Battery:	13.6V battery—provides 1 hour continuous operation
Temperature Range:	0° to 55°C operating −40° to 85°C storage
Dimensions:	8.25 in. high x 15.75 in. wide x 20.75 in. deep 21 cm x 40 cm x 52.7 cm
Weight:	45 lbs. (basic model) excluding battery pack, cover and accessories 20.5 kg

Model Nomenclature

R-2001A	Basic model
R-2001A/220	Basic model shipped wired for 220V operation
R-2001A/HS	With high stability oscillator
R-2001A/HS/220	High stability oscillator and 220V operation
R-2002A	With IEEE-488 Bus
R-2002A/220	IEEE-488 Bus and wired for 220V operation
R-2002A/HS	IEEE-488 Bus and high stability oscillator
R-2002A/HS/220	IEEE-488 Bus, high stability oscillator and 220V operation

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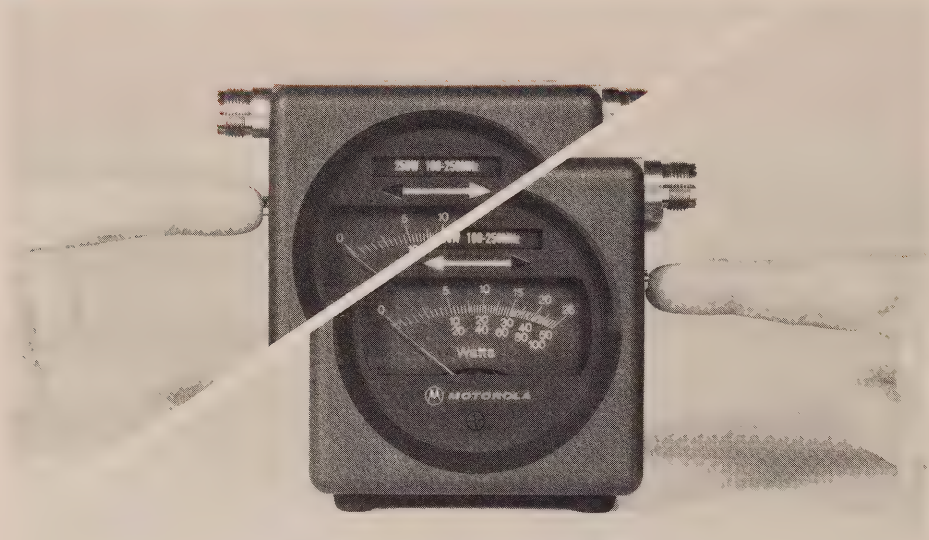
MOTOROLA

Wattmeter

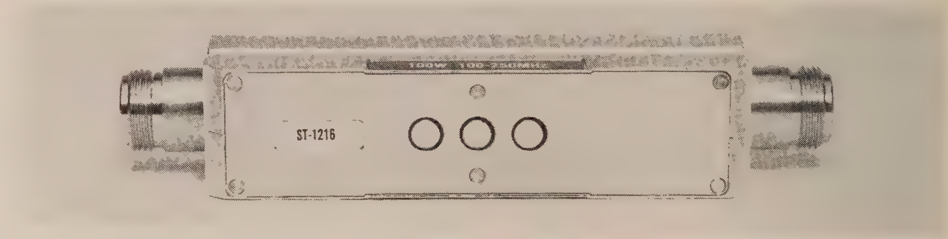
Model S-1350C

You Get All These Features in One Wattmeter Only from Motorola



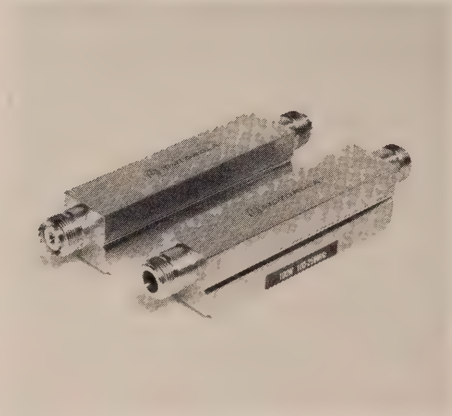
Both forward and reflected power can be read at the push of a button.

All information is right up front, and easily seen at a glance.

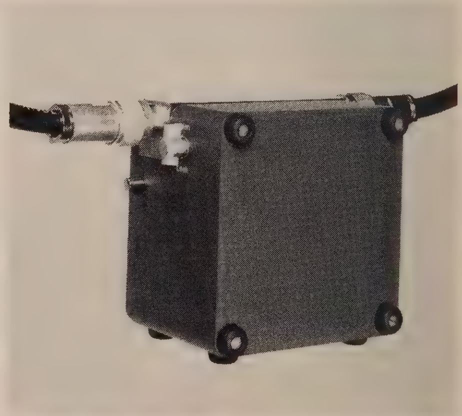


The r-f cavity and sense line is an integral part of the sealed temperature compensated element, eliminating variations in accuracy, VSWR, and losses in the measurement system throughout the life of the element.

The attractive, durable carrying case has a convenient compartment for three elements and a separate pocket for the instruction manual.

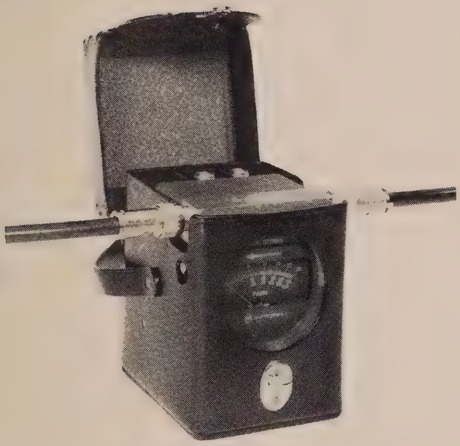


Both "UHF" and "N" element connectors are available, plus a variety of adaptors.



The meter can be easily and conveniently locked on to an in-line element with the twist of a lever.

The inexpensive, sealed element can be left in the line, eliminating the need to go off-the-air before taking a power reading.



It is unnecessary to remove the meter from its protective leather case for operation.

Elements snap in and out quickly, easily.

An accessory element carrying case, with room for a dozen elements, is available.

The most compact wattmeter available today!

Wattmeter

Specifications

Metering Method:	Insertion type RF wattmeter. Indicates forward or reverse power by switch operation.
Emissions Measured:	CW or FM carrier, SSB average, AM or TV at zero modulation only.
Frequency Range:	2 MHz to 1 GHz with appropriate elements.
Power Measurement Ranges:	2.5 watts to 2500 watts full scale with appropriate elements.
Accuracy:	±5% full scale.
Input/Output Impedance:	50 ohms.
VSWR:	1.2:1 max. with "N" type connectors.
Insertion Loss:	0.2 dB max.
Dimensions:	Meter: 4″ x 4¼″ x 3¼″ including feet, less element. Element: 1″ x 1¼″ x 5¼″ including connectors.
Weight:	Meter: 21 oz. Elements: 10 oz.

Description	Model Number
Wattmeter	S-1350C
Meter Carrying Case	ST-1198
Element Carrying Case	ST-1199
Male "N" to Female "UHF" Adaptor	58-82273CO1
Male "UHF" to Female "N" Adaptor	58-83150DO1
Male "UHF" to Female "BNC" Adaptor	58-855270
Male "N" to Female "BNC" Adaptor	58-84300A98

Wattmeter Elements

Frequency (MHz)	Maximum Power (Watts)	"N" Type Connector Model	"UHF" Type Connector Model
2-30	250	—	ST-1296
2-30	2500**	—	ST-1299
25-60	5	ST-1280B	ST-1281B
25-60	10	ST-1285B	ST-1284B
50-125	5	ST-1283B	ST-1282B
50-125	10	ST-1286B	ST-1287B
25-100	25	ST-1204B	ST-1244B
25-100	50	ST-1205B	ST-1245B
25-100	100	ST-1206B	ST-1246B
25-100	250	ST-1207B	ST-1247B
25-100	500	ST-1208B	ST-1248B
100-250	5	ST-1212B	ST-1252B
100-250	10	ST-1213B	ST-1253B
100-250	25	ST-1214B	ST-1254B
100-250	50	ST-1215B	ST-1255B
100-250	100	ST-1216B	ST-1256B
100-250	250	ST-1217B	ST-1257B
100-250	500	ST-1218B	ST-1258B
200-550	2.5	ST-1221B	ST-1261B
200-550	5	ST-1222B	ST-1262B
200-550	10	ST-1223B	ST-1263B
200-550	25	ST-1224B	ST-1264B
200-550	50	ST-1225B	ST-1265B
200-550	100	ST-1226B	ST-1266B
200-550	250	ST-1227B	ST-1267B
200-550	500	ST-1228B	ST-1268B
500-1000	2.5	ST-1231B*	ST-1271B
500-1000	5	ST-1232B*	ST-1272B
500-1000	10	ST-1233B*	ST-1273B
500-1000	25	ST-1234B*	ST-1274B
500-1000	50	ST-1235B*	ST-1275B
500-1000	100	ST-1236B*	ST-1276B
500-1000	250	ST-1237B*	ST-1277B
500-1000	500	ST-1238B*	ST-1278B

*The N type connector is recommended for best accuracy in the 500-1000 MHz frequency range.
**Calibrated at 1000W, but usable to 2500W.

Support Services

For service on your Motorola test equipment, in the U.S. contact the Motorola Test Equipment Repair Center, 1313 E. Algonquin Rd., Schaumburg, Illinois 60196 or call the Test Equipment Repair hotline—800/323-6967. Outside the U.S., contact your nearest Motorola subsidiary.

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Equipment covering the recently released 800 MHz frequency spectrum will soon be shipping. This information is being presented to start preparing you, the MSS, for your role in this new area of opportunity.

At present, frequencies in this range have been in the point-to-point category and did not fall into common domain or usage. Now there will be complete systems with mobiles, consolettes, base stations - local and remotely controlled - in short, everything that we are familiar with in the Low, VHF and UHF bands. As was the case when UHF frequencies were introduced, there are some aspects of the 800 MHz frequencies that will require special care or considerations. Perhaps some of these are familiar to you and will fall in the realm of being "obvious". Perhaps they will be simply items to which you have not given much thought in connection with 800 MHz frequencies. In order to start your thinking and your planning in the proper manner, the following items are mentioned as points to ponder for the future:

<u>Frequency Measuring Equipment</u>. As in other bands, frequency measurements will be required and adjustments made to keep the equipment within the prescribed tolerances. The most stringent requirement is for base station transmitters to have a stability of .0001%. Consequently, any frequency measuring instrument's stability should be at least five times that of the unit being measured. All your present equipment should be checked to see if it will meet this requirement and that it is within calibration. Calibration may be required more often to stay within legal limits.

<u>Deviation Monitor</u>. Calibration and specifications of deviation units should be checked to insure that deviation measurements will be correct.

<u>Frequency Generating Equipment</u>. For proper alignment of your receivers in the 800 MHz band, accurately calibrated output levels at the 800 MHz frequency must be generated. If present equipment will not meet this requirement, it may be necessary to develop new techniques to obtain a calibrated output at these frequencies.

<u>Watt Meters</u>. Check present power indicating devices to see if their specifications permit measurement up to 1000 MHz. Accuracy at this level will also be a factor.

<u>Termination Devices</u>. As with the Watt Meters, terminations of dummy loads should also be checked for proper frequency specifications.

<u>Cables</u>. Cable attenuation will be a much greater factor for 800 MHz than other frequencies. Present usage of RG8 and RG58 cables is not advised. Whenever a flexible cable is needed, the recommended cables will be a RG37 and RG400. If flexibility is not a requirement, then a heliax line should be used. In all usage of flexible cable, keep the line as short as possible.

Connectors. The use of "PL 259" connectors is not recommended for the 800 MHz band. Type "N" and "BNC" connectors are recommended. 800 MHz mobiles will have a UHF or "PL 259" female antenna connector. However, this will be properly terminated in the mobile to reduce losses. Base station equipment will utilize type "N" and "BNC" connectors.

For further information some other comments will be offered here without dwelling on their reasons at this time. These are:

Transmit and Receive Frequencies will be separated by 45 MHz. The transmit frequency is below the receive frequency on mobiles and the reverse on base stations.

Trunk Mounting of Antennas is not recommended due to distortion of the radiation pattern and the shielding effect. Roof mount antennas are preferable.

Do not utilize existing antenna mounts by simply replacing the existing antenna. The existing mount and the antenna cable would be detrimental at 800 MHz.

Channel spacing on 800 MHz will be the same as that at 450 MHz.

A phenomenon noted to a certain extent at 450 MHz will become very noticeable at 800 MHz. This is a "normal" condition of cable heating. Under normal operating conditions, it is expected for the cables to become warm or even hot. This does not necessarily indicate a defective cable or a bad VSWR ratio.

The foregoing have been food for thought as the new horizon of opportunity is approached. Motorola's intention is to provide you with as much knowledge of the 800 MHz frequency spectrum as is possible prior to actual shipment of the equipment. Once the equipment is shipping, further service training will be forthcoming, including recommendations, specifications and availability of test equipment for servicing the new frequency band. This will provide you, the service technician, with the necessary tools and knowledge to maintain the newest equipment with the same competence you have exhibited in the servicing of present day Motorola equipment.

Mel Minniear
Technical Training Center